

Preventing the **N**ightmare

Technical Appendices

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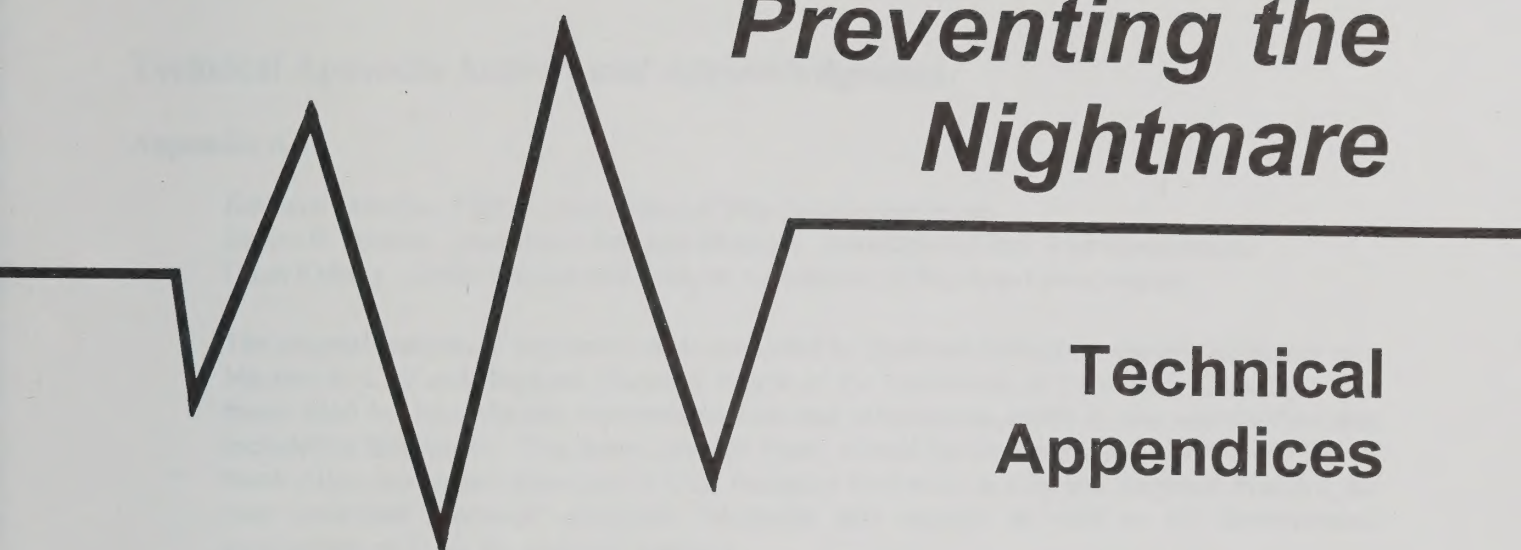
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OCTOBER 1999

ASSOCIATION OF BAY AREA GOVERNMENTS



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The original analysis of the survey was conducted by Kathleen Mikulis as partial fulfillment of a Masters in City and Regional Planning degree at the University of California, Berkeley. The thesis filed by Ms. Mikulis incorporates data and information which is less current than that included in this report. This report, not her thesis, should be used and cited. She would like to thank Allan Jacobs and John Landis, U.C. Berkeley Professors in City and Regional Planning for their continued guidance, assistance, feedback, and support, as well as for demonstrated applications of SPSS for statistical analysis.

Patrick McClellan, former Emergency Services Coordinator, and Stephan Kiefer, former Building Inspector, City of San Leandro, provided information on San Leandro's retrofit program. Arrieta Chakos, Emergency Services Coordinator, City of Berkeley City Manager's Office, provided information on Berkeley's retrofit program.

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For information on ABAG's Earthquake Program, hazard maps by city, and other earthquake impacts, see our Internet site at:
<http://quake.abag.ca.gov>

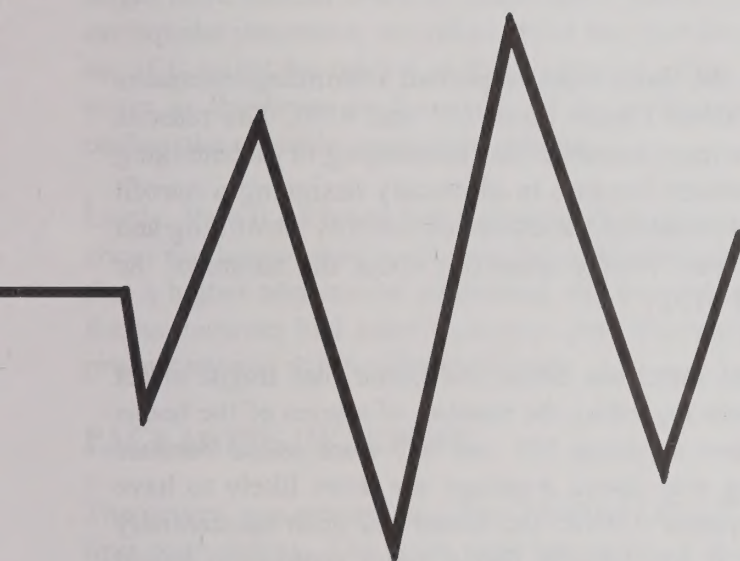
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Technical Appendix A

Analysis of Data from a Survey of Owners of Single-Family Homes

This Appendix contains information on the percentages of owners of single-family homes responding to our survey that have retrofitted their homes. These numbers are not an accurate measure of the actual percentage of homeowners who have retrofitted because people who retrofitted were more likely to respond to our survey. Therefore, please use the percentages found in Appendix C as an estimate of actual retrofit rates. However, data on the reasons for retrofitting (from the sample of those who retrofit) and the reasons for not retrofitting (from the sample of those who have not retrofitted) contained in this Appendix are statistically valid.



Technical Appendix A

Analysis of Data from a Survey of Owners of Single-Family Homes

INTRODUCTION

The Association of Bay Area Governments (ABAG) conducted a Homeowner Earthquake Retrofit Survey in the spring and summer of 1998. This survey was part of a larger project funded by the National Science Foundation to help design a model earthquake program to be used at the city or county level. This model program would attempt to maximize conditions homeowners say would motivate them to structurally retrofit their single-family homes. The purpose of this survey was to gather data and information that can be used towards designing this program. A total of 6,558 surveys were sent to owners of single-family homes built prior to 1960 in selected census tracts within 14 cities and 3 unincorporated areas of the Bay Area. Overall 27.7% of the surveys with valid addresses were returned. Homeowners who had retrofitted, or who had higher incomes or educational attainment, were more likely to return the questionnaires.

SURVEY DESIGN

ABAG Earthquake Program staff developed the Bay Area Earthquake Safety Survey. The survey went through ten drafts with various questions added, subtracted, or refined by other ABAG staff and ABAG's Housing Mitigation and Recovery Earthquake Review Committee. The process of creating the finished survey instrument took approximately three months.

QUESTIONS INCLUDED

Part I

Part I included the crucial questions regarding the three most important retrofitting measures (#6), and the reasons these measures have or haven't been taken (#7 and #14). The reasons included were those that we thought would be the most important in encouraging or discouraging a retrofit. These questions were of utmost importance because in ultimately designing a retrofit program for cities, such a program would want to minimize the obstacles towards retrofitting and stress the reasons *to* retrofit. In addition, there were related questions about the nature of the retrofit work that were included in the survey (#8-#13).

The first four questions of Part I also included questions about the home that might affect whether or not the owner would retrofit. Questions regarding the number of stories of the house and whether or not there was living space above a garage (#1 and #2) were asked because multiple-storied houses and homes with a living area above a garage are more likely to have structural problems. Additionally, the survey inquired whether the house had been substantially changed with a major renovation (#4), because it was thought that a major renovation would trigger a retrofit.

A question on nonstructural retrofitting (#5) was asked to try to help homeowners distinguish between nonstructural and structural retrofits and to determine whether or not homeowners that performed nonstructural retrofits were more likely to perform structural retrofits. Finally, the survey included a question that asked in what decade the home was originally built (#3), in order to measure the accuracy of the MetroScan data (which will be discussed later).

Part II

The questions in Part II, as stated on the survey, were used to help classify the responses. Many of the questions here assessed factors affecting perception of risk, which were thought to directly affect a homeowner to take action to retrofit. Such questions included whether or not the owner lived in the home or in California at the time of the 1989 Loma Prieta earthquake (#A), whether the homeowner had experienced a major damaging earthquake (#B), and what the homeowner perceived as the risk of a major earthquake affecting the home's neighborhood (#C).

A question was asked about whether the homeowner knew someone who had completed structural work on their home (#D). This was included because we believed that a "lemming effect" might be a factor in retrofitting – that knowing someone who had undertaken a retrofit would encourage a homeowner to retrofit. Additionally, we asked a question regarding whether the owner lived in the home or whether it was rented out (#F), because it seemed plausible that owners living in the homes would be more likely to retrofit, because they would have a more personal stake in the matter.

Part II also included questions regarding the earthquake education and preparedness of the homeowners. One question inquired whether or not the owner had seen ABAG's earthquake shaking hazard maps (#E), because it was thought that greater earthquake education about the

danger of the home's location might trigger a retrofit. A question regarding earthquake insurance was also included (#G). It was thought that someone that recently stopped paying for insurance, might have instead opted to undertake a retrofit. Additionally, with the recent changes in state earthquake insurance, we asked about the year the insurance was canceled by the homeowner to see if it might be related to these changes. Also, a question was included regarding food and water in the home in the event of an earthquake (#H), in order to gauge the homeowner's earthquake education and preparedness.

Lastly, Part II included key demographics questions about the homeowner. Questions inquired about the homeowner's educational attainment and income (#I and #K), because it was thought that a higher educational attainment and income would have a positive effect on whether or not the homeowner had acted to at least partially retrofit. Question #J was added after the Alameda pre-survey and will be discussed later.

PACKAGING OF SURVEY

The survey was printed on a blue sheet of 11"x17" paper, and was then folded in half to create a four-page survey. The front page consisted of the cover letter, with statements in Spanish and Chinese about the existence of a language hotline that respondents could call to have an ABAG staff member administer the survey in these languages. A statement was also included in Vietnamese that stated that the recipient should find someone who knows English to help translate the survey. The last page was devoted solely to respondents' comments and suggestions. The survey was then mailed first class in an ABAG envelope (refer to copy of survey, reminder postcard, letter sent with second survey, and additional postcard in Attachments).

SITE SELECTION

Because we plan to use this survey data to design a model program to be used at the city or county level, we focused our survey on 17 jurisdictions that are located on or adjacent to active earthquake faults. We looked at specific communities as opposed to the entire Bay Area, because it was essential that we be able to make comparisons between communities.

Berkeley and San Leandro were specifically chosen because these cities have aggressive programs in place to encourage homeowners to retrofit. In designing a model program, we wanted to test the effectiveness of these two existing programs through the survey. Both cities have taken very different approaches towards encouraging residents to retrofit.

CITY RETROFIT PROGRAMS

Berkeley's Program

Berkeley's Seismic Retrofitting Incentive Program is in place to prevent housing damage in an earthquake by mitigating structural problems of residences. This program is a joint effort of the Planning, Housing, and Finance departments, and provides two monetary incentives to homeowners. First, City permit fees are waived for the seismic retrofitting of non-strengthened

homes and unreinforced masonry structures. City staff believe that low-income homeowners have been helped by this incentive, and middle- and upper-income homeowners have increased their retrofitting efforts because of this incentive, though to a lesser degree.

Second, there is a 1.5% tax levied by the City on property transfer transactions. Up to one third of this amount can be used toward seismic upgrades during the sale of property. Upgrades which qualify include foundation repair or replacement, mudsill repair or replacement, foundation-to-mudsill bolting, wall bracing in basements, shear wall installation, securing chimneys, and wall heater anchoring. Further information on both of these incentives is included in Technical Appendix C.

The Seismic Retrofitting Incentive Program is part of a series of efforts the City of Berkeley has undertaken since the 1989 Loma Prieta earthquake to address disaster preparedness and mitigate potential hazards. These activities have included:

- ◆ Setting up a municipal Office of Emergency Services
- ◆ Establishing a Citizen's Emergency Response Training program
- ◆ Developing a set of comprehensive standards on mitigation policy and public building design (with the help of U.C. Berkeley seismic safety experts)
- ◆ Developing a residential seismic retrofit incentive program based on these standards; and
- ◆ Proposing two seismic safety bond measures to upgrade public buildings and infrastructure that were passed by City voters.

The City's Office of Emergency Services (OES) administers emergency response training which is vital in reducing shelter needs following an earthquake or other disaster, and is targeted for both staff and citizens.

San Leandro's Program

San Leandro created an award-winning Home Earthquake Retrofit Program in order to mitigate the effects of an earthquake on the City's housing stock. There is a large proportion of older, wood-framed buildings in San Leandro; these are particularly vulnerable since the same type of construction is expected to make up a significant portion of uninhabitable dwellings after a major earthquake.

As a result, to encourage homeowners to retrofit their homes, the City developed a technical assistance program which contains four basic elements: a set of publications to aid the resident in starting the retrofit, a separate inspection and permit for this project, a tool-lending "library" for those homeowners doing the retrofit work themselves, and community training for retrofit construction.

The Homeowner's Handbook was published to illustrate how to strengthen wood-framed houses against earthquakes, and was mailed to all single-family residents in San Leandro. The Prescriptive Standard and Plan Set – a more detailed publication – was developed. It includes a set of construction details for strengthening wood-frame houses and a standard scope of work for contractor bids. Information specified by the homeowner on the Plan Set facilitates the City's application process for retrofit work and permit approval. Both the Plan Set and the Prescriptive

Standard are available to residents at no cost.

To ensure that the job will be thorough and cost-effective, the City offers a pre-construction inspection specifically for earthquake retrofit work. Additionally, permit fees are reduced to low rates to minimize the amount of households avoiding the work because of cost.

A tool lending “library” was established in order to allow homeowners with “do-it-yourself” initiative to borrow equipment to execute the retrofit (under the prescribed standard) at no charge.

Finally, the City offers a series of five 2-hour construction workshops for residents who want to do the bolting and bracing of their homes on their own. This Seismic Strengthening of Wood Frame House series is taught by both City staff and industry experts, and is offered quarterly at a nominal charge. It also covers non-construction safety measures for homes. In addition, Contractor Seismic Safety Training is a required one day course for contractors who want to be included on a list of qualified retrofit contractors available to homeowners in the city.

Comparison of Programs

Berkeley’s approach is primarily to create a program of economic incentives through the waiver of permit fees and the rebate of property transfer taxes. However, the City also has a community-wide approach. Although not as “hands on” an approach as San Leandro’s program, Berkeley’s program is far-reaching, having involved thousands of community members and staff.

On the other hand, San Leandro’s program is much more “hands on.” This program largely encourages homeowners to do the retrofit work themselves, or at least get more personally involved with it through publications, workshops, and a tool lending “library.” The City also exercises monetary incentives, though to a lesser extent than Berkeley, through the lowering of permit fees (but not the waiver of those fees).

SELECTION OF CITIES AND UNINCORPORATED AREAS

Other cities were chosen that had similar demographics to Berkeley and San Leandro in order to make comparisons. Cities were also selected so that comparisons could be made among different regions of the Bay Area. We looked at three unincorporated areas so as to examine the effectiveness of county versus city governments in encouraging retrofitting (refer to TABLE A1 – *Targeted Cities: Targeted Census Tracts and Pre-1960 Homes*).

The following cities and unincorporated areas were selected to receive our survey.

Cities with Innovative Programs

Berkeley and San Leandro, as stated above, were chosen in order to determine the effectiveness of their city retrofit programs.

TABLE A1 — Targeted Cities
Targeted Census Tracts and Pre-1960 Homes

<i>Jurisdiction</i>	<i>Number of Census Tracts</i>	<i>Number of Targeted Census Tracts</i>	<i>Percentage of Total Tracts</i>	<i>Number of Pre-1960 Homes (est.)</i>	<i>Pre-1960 Homes in Targeted Tracts (est.)</i>	<i>Percentage of City Total</i>
Oakland	112	7	6.3%	56,283	5,594	9.9%
San Francisco	152	13	8.6%	87,444	14,207	16.2%
San Jose	173	6	3.5%	39,663	6,066	15.3%
Berkeley	31	6	19.4%	18,416	5,134	27.9%
San Leandro	20	5	25.0%	13,691	4,615	33.7%
Alameda	20	5	25.0%	8,082	4,287	53.0%
Concord	25	4	16.0%	9,563	4,088	42.7%
Daly City	20	2	10.0%	10,042	2,687	26.8%
Los Gatos	14	2	14.3%	3,200	1,787	55.8%
Napa	13	3	23.1%	6,558	3,436	52.4%
Palo Alto	21	5	23.8%	12,432	6,571	52.9%
Richmond	21	4	19.0%	13,276	5,029	37.9%
Santa Clara	30	4	13.3%	9,050	1,842	20.4%
Santa Rosa	26	4	15.4%	7,660	4,198	54.8%
Ashland-San Lorenzo	9	2	22.2%	8,159	1,974	24.2%
Crockett	1	1	100.0%	768	768	100.0%
Lexington Hills	1	1	100.0%	505	505	100.0%
Total	689	74	10.7%	304,792	72,788	23.9%

Berkeley

This city of 107,800¹ is home to the University of California, and as a result many students and faculty live here. Berkeley is one of the oldest cities of the Bay Area; 90% of single family homes were built before the 1960s – 70% before the 1940s. The west and southwest parts of the city are more low-income and industrial, the flatlands in the middle are more middle-income, and the eastern hills are higher-income areas. Consequently there is much social and ethnic diversity in Berkeley. Partly because of the student presence, Berkeley is predominantly a city of renters, especially near the campus, and many older homes have been converted into apartments. The City is famous for its counterculture which exploded in the 1960s and 70s, and still exists today. Additionally, Berkeley is well known for its gourmet and organic restaurants and food stores, and upscale shopping districts. Fire devastated the Berkeley-Oakland Hills in 1991, killing 25 people and destroying thousands of housing units. In addition, earthquakes on either of the northern or southern Hayward fault segments would impact Berkeley. Consequently, there have been very visible retrofits of Berkeley's City Hall and Cragmont Elementary School in the last few years.

San Leandro

San Leandro, with a population of 74,300, is located just south of Oakland between the Bay and the hills, and includes many older neighborhoods. The flatlands to the west are adjacent to industrial areas and are largely low- to middle-income, while to the east the neighborhoods become slightly higher in income. Though the City is largely built out, newer homes are being constructed along the waterfront; however, there are still many blue-collar workers that live in San Leandro. The City has very high rates of home ownership, and there are many elderly residents, with almost one-third of the population over age 55. Additionally, the City is quite ethnically diverse. San Leandro would be severely impacted by an earthquake on the southern Hayward fault.

Large Cities

Oakland, San Francisco, and San Jose are the largest cities in the Bay Area, and as such we can examine whether or not such cities intimidate homeowners from approaching them for needed retrofit information. Also, these cities have many older homes, and retain a variety of demographic characteristics among tracts.

Oakland

As the largest and most populous city in Alameda County with 396,300 people, Oakland is an industrial center with the Bay Area's major container port. Oakland is an extremely diverse city; west of Interstate 580 in the flatlands, are some of the poorest homes in the Bay Area, while east of Interstate 580 in the hills are some of the richest. The flatland housing was largely built prior to World War II, and there are many older homes throughout the City. Additionally, Oakland is next door to Berkeley where the University of California is located, and as a result many students and faculty live in Oakland's northern neighborhoods. Oakland is a very diverse city with a large Asian population in and around downtown, especially those of Chinese and Vietnamese ancestry. In addition, Oakland has a large African-American population. The Berkeley-Oakland Hills fire devastated the City's northern hill communities in 1991. Only two years before the City was hit

¹ All population estimates are the 1998 figures from the California Department of Finance unless otherwise noted.

by the 1989 Loma Prieta earthquake, causing Interstate 880's Cypress Structure, a double-deck stretch of the freeway, to collapse. A portion of the San Francisco-Oakland Bay Bridge also collapsed, and the earthquake seriously damaged many buildings in Oakland's downtown. The northern and southern Hayward fault have the potential to seriously impact Oakland and portend an even more disastrous event.

San Francisco

Although San Francisco is only the second most populous city in the Bay Area with a population of 789,600, it is the historical and cultural center of all of Northern California. With over 80% of the housing stock consisting of multifamily homes, San Francisco is primarily a city of renters. With the postwar housing boom, much of San Francisco's middle class left for the suburbs; however, in the last two decades the city has become a magnet for white-collar professionals. There are many distinct neighborhoods in San Francisco, with significant Asian and Latin American populations, in addition to a large gay population. Residents of the City are also famous for being very liberal. In 1906 a major earthquake and fire destroyed most of the downtown, leaving 300,000 people homeless. Following the 1989 Loma Prieta earthquake, many of the nearby double-decker freeways were torn down because of earthquake damage and concern for their performance in a future earthquake. The San Andreas and northern Hayward faults pose the greatest threat to San Francisco in an earthquake.

San Jose

The most populous city in the Bay Area, San Jose is home to a population of 894,000, and is viewed by many as the capital of Silicon Valley. With predominantly single family homes, it is a suburban, middle-class city, without too much income stratification. San Jose grew rapidly after 1950, and gained nearly a quarter of its residents in the last decade. The city has poured money into the downtown to remake it into a strong cultural center. Additionally, with significant Mexican and Vietnamese populations, the city is quite ethnically diverse. Although the Monte Vista and other faults of the Foothills fault system are the closest to San Jose, the more dangerous San Andreas and southern Hayward faults are located nearby as well.

East Bay Cities

The East Bay cities of Alameda, Concord, and Richmond were chosen for the survey since they face potential danger from the Hayward or Concord faults.

Alameda

Alameda's location in the East Bay makes it comparable to both Berkeley and San Leandro, since it is located nearly halfway between the cities. Alameda is an island city located just off the coast of Oakland with a population of 72,500. The City also includes part of the Bay Farm Island peninsula - a higher-income enclave located just north of the Oakland Airport. Alameda is one of the Bay Area's older cities, with many older Victorian-era homes, and generally a mixture of residential dwelling types in this predominately middle- and upper-middle-income community. Currently, Alameda is going through some major changes since the naval base and air station - which occupied the northern sector of the main island - closed in 1997, with many high-tech firms already relocating to the base. The northern and southern Hayward fault segments pose the greatest seismic threat to Alameda, especially since the island is largely composed of Bay mud

and fill which may liquefy in a major earthquake.

Concord

This is the most populous city in Contra Costa County with 113,400 people. It is a relatively newer city in the Bay Area and experienced rapid growth in the 1950s and 60s. Near downtown are low- to middle-income homes and apartments from just after World War II. Beyond Concord's core area, the City is more middle-class in character with larger homes. Although Concord was traditionally a working class city, it is changing and now has more of a suburban feel. The Concord fault runs through the City.

Richmond

With its 92,800 people, Richmond is the second largest city in population in Contra Costa County. During World War II, a major shipyard was located here, and, in only a few years, the population exploded to 100,000. Afterwards, however, the City suffered from postwar decay as people moved away to the suburbs. Richmond continues to be an ethnically diverse city, with a large African-American population. The downtown neighborhoods are now generally low-income areas with severe crime problems. However, some neighborhoods, such as Point Richmond, are more middle-income areas and suburban in character. Today, the Chevron refinery and other heavy industries are located in Richmond, as well as some emerging software and biotechnology firms. The northern Hayward fault runs through Richmond.

Peninsula and South Bay Cities

Daly City, Los Gatos, Palo Alto, and Santa Clara were chosen to represent the Peninsula and South Bay. Except for Daly City, these cities contain high technology industries and middle- to high-income populations. These areas saw considerable damage in the 1989 Loma Prieta earthquake because of their proximity to the epicenter.

Daly City

With a population of 103,400, Daly City is San Mateo County's most populous city, encompassing an area that spans the peninsula, and includes the San Andreas fault. Primarily a middle-income city, most of the housing here was built in the postwar period, although some older homes are near BART at the City's northern border. There is a large Asian-American population here, with a substantial Filipino community. Daly City's demographics and proximity to San Francisco make it comparable to parts of San Francisco; however, it is a smaller city.

Los Gatos

Los Gatos, population 30,100, is one of the higher-income cities of Santa Clara County with many large suburban homes. Los Gatos is essentially built out and is famous for opposing growth. The 1989 Loma Prieta earthquake brought major damage to older buildings, as well as minor damage to newer homes, since the City is near the Santa Cruz Mountains epicenter and the fault which caused that earthquake. After the earthquake, Los Gatos revised its building codes to protect reconstructed structures from future earthquakes.

Palo Alto

This city of 60,500 in Santa Clara County has some of the highest median housing prices in the entire Bay Area. The downtown area is quite upscale and is a cultural and commercial center of the South Bay. With Stanford University nearby, the educational attainment of Palo Alto is comparable to Berkeley. Although the university had over \$100 million in damage from the 1989 Loma Prieta earthquake, the City emerged relatively unscathed. Palo Alto has an aggressive Unreinforced Masonry Retrofit (URM) program in place which was one of the first in the Bay Area.

Santa Clara

This South Bay city is representative of cities in the area with middle- to higher-income residents living in single-family homes in a suburban setting. Most of Santa Clara was built in the 1950s and 60s, and now the City has a population of 101,900. The City is home to many high-tech companies, as well as Great America, an amusement park. The Foothills, San Andreas, and southern Hayward faults are all in close proximity to Santa Clara.

North Bay Cities

In addition, Napa and Santa Rosa were chosen to study because they are the largest cities in their respective counties, and are located on faults that threaten the North Bay – the West Napa and Healdsburg/Rodgers Creek faults.

Napa

Napa, with 69,300 people, is the largest city in Napa County, and a tourist destination because of its proximity to wine country. Despite much postwar growth, the City has kept a strong downtown. Rural agriculture, particularly viniculture, exists at the city limits, and Napa strives to not grow into these undeveloped areas. Napa has been home to many floods in past years and is located adjacent to the West Napa fault.

Santa Rosa

With a population of 136,100, Santa Rosa is the largest city of Sonoma County. It is located near Sonoma County's wine country, and has jointly small town character in the downtown, and a suburban feel to the rest of the City. With a largely middle class population a distance away from San Francisco, the single family homes here are more affordable than much of the rest of the Bay Area. As a result, Santa Rosa has grown rapidly in the last few decades. Moderate earthquake damage occurred here in 1969, and there is an aggressive URM program in place, as the City is located on the Healdsburg/Rodgers Creek fault.

Unincorporated Areas

The unincorporated areas of Ashland-San Lorenzo, Crockett, and Lexington Hills are without city government. Thus, homeowners living in these areas would be dealing with county building department staff and county programs. These unincorporated areas are near cities that were also studied, and have approximately the same level of risk. Therefore, responses of homeowners living in unincorporated areas can be compared to those living in cities.

Ashland-San Lorenzo

Ashland and San Lorenzo are two adjoining unincorporated areas with a combined population of 36,577² between San Leandro and Hayward. Ashland and San Lorenzo's proximity to San Leandro make them good unincorporated areas to study because their demographics are similar to San Leandro's. San Lorenzo is located between the Bay and Interstate 880, while Ashland is to the northeast between Interstates 880 and 580 – just to the west of Castro Valley, another unincorporated area. There are many older homes here because this area exploded in growth just after World War II, and is now built out. Ashland and San Lorenzo are primarily middle-income communities and are ethnically diverse. They are located near the southern Hayward fault segment.

Crockett

Crockett is a community of 3,228 on the Carquinez Strait in Contra Costa County – south of Vallejo. Crockett was a company town, with the company – C&H Sugar and its refinery – still a prominent feature in the landscape. It is an older working class, self-contained community, with unique downtown charm. While newer homes have been built on the hills, the majority of homes are older and near the center of town. Crockett is located between the northern Hayward and Concord faults.

Lexington Hills

With a population of 2,064, Lexington Hills is located south of Los Gatos in Santa Clara County – north of the Santa Cruz County border. Its proximity to Los Gatos makes Lexington Hills ideal for comparing the two areas which have similar demographics but different types of local government. Due to location on the San Andreas fault near the Santa Cruz Mountains, it is one of the nearest communities to the source of the 1989 Loma Prieta earthquake. As a result many of the homes suffered major structural damage. Lexington Hills is a fairly affluent community, with homes that were predominantly built after World War II.

SELECTION OF CENSUS TRACTS

Surveys were sent to selected census tracts within cities. By targeting specific census tracts, we were able to use demographic data from the U.S. Census to track any skewing. The census tracts that were considered had a large number of homes built before 1960. We then looked at the census data on income, educational attainment, and linguistic isolation for the tracts fulfilling the first part of the criteria. Tracts were chosen so as to represent a wide spectrum of these variables, because we believed they might have a large effect on retrofit rates.

SELECTION OF HOMES

We acquired MetroScan data for the homes within each census tract. MetroScan is a subsidiary of the Trans America Corporation that possesses county assessors' data files. These data files included basic information about the home such as the decade it was built, the number of stories, the date it was purchased, and the square footage. In addition these files possess critical information such as site addresses of each home and the mailing addresses for the owner. Only

² 1998 population estimates for the unincorporated areas were unavailable from the California Department of Finance. Therefore, the population information cited is from the 1990 Census.

single family homes built prior to 1960 were considered from the MetroScan data. In order to obtain a representative sample of homeowners, while at the same time avoiding a “blanketing” of neighborhoods, we used a random sample of approximately 10% of these addresses. In jurisdictions with few older homes (Ashland-San Lorenzo, Crockett, and Lexington Hills) a 20% sample was used.

SURVEY PROCEDURES

ALAMEDA PRE-SURVEY

A pre-survey was sent to Alameda on May 4, 1998, followed by a reminder postcard, and a second survey (refer to TABLE A2 – *Alameda Pre-Survey*). No unanswered surveys or surveys with the site address torn off were returned to ABAG during the course of the pre-survey. However, during the later survey sent to the other 16 jurisdictions, these events became much more commonplace.

TABLE A2 – Alameda Pre-Survey^{1,2,3,4}

Date	Day	Day #	# Returned Surveys	Cumulative Total	Cumulative Total %	\$ Cost	\$ Cost/Survey
5/4/98	Monday	4	17	17	4.06	7.74	0.46
5/5/98	Tuesday	5	11	28	6.68	5.52	0.50
5/6/98	Wednesday	6	11	39	9.31	8.94	0.81
5/7/98	Thursday	7	5	44	10.50	6.60	1.32
5/8/98	Friday	8	5	49	11.69	4.08	0.82
5/11/98	Monday	11	5	54	12.89	3.24	0.65
5/12/98	Tuesday	12	0	54	12.89	0	Not Applicable
5/13/98	Wednesday	13	0	54	12.89	0	Not Applicable
5/14/98	Thursday	14	6	60	14.32	5.40	0.90
5/15/98	Friday	15	0	60	14.32	0	Not Applicable
5/18/98	Monday	18	0	60	14.32	0	Not Applicable
5/19/98	Tuesday	19	3	63	15.04	1.26	0.42
5/20/98	Wednesday	20	0	63	15.04	0	Not Applicable
5/21/98	Thursday	21	5	68	16.23	1.68	0.34
5/22/98	Friday	22	2	70	16.71	1.52	0.76
5/26/98	Tuesday	26	0	70	16.71	0	Not Applicable
5/27/98	Wednesday	27	2	72	17.18	0.84	0.42
5/28/98	Thursday	28	0	72	17.18	0	Not Applicable
5/29/98	Friday	29	0	72	17.18	0	Not Applicable
6/1/98	Monday	32	1	73	17.42	0.42	0.42
6/2/98	Tuesday	33	1	74	17.66	0.42	0.42
6/3/98	Wednesday	34	0	74	17.66	0	Not Applicable
6/4/98	Thursday	35	1	75	17.90	0.42	0.42
6/5/98	Friday	36	0	75	17.90	0	Not Applicable
6/8/98	Monday	37	1	76	18.14	0.42	0.42
6/9/98	Tuesday	38	0	76	18.14	0	Not Applicable
6/10/98	Wednesday	39	1	77	18.38	0.42	0.42

(Responses continued on next page)

TABLE A2 – Alameda Pre-Survey

Date	Day	Day #	# Returned Surveys	Cumulative Total	Cumulative Total %	\$ Cost	\$ Cost/Survey
6/11/98	Thursday	40	0	77	18.38	0	Not Applicable
6/12/98	Friday	41	0	77	18.38	0	Not Applicable
6/13/98	Monday	42	1	78	18.62	0	Not Applicable
6/14/98	Tuesday	43	0	78	18.62	0	Not Applicable
6/15/98	Wednesday	44	1	79	18.85	0.42	0.42
6/16/98	Thursday	45	0	79	18.85	0	Not Applicable
6/17/98	Friday	46	0	79	18.85	0	Not Applicable
6/18/98	Monday	47	1	80	19.09	Unknown	Unknown
6/23/98	Tuesday	55	1	81	19.33	0.42	0.42
6/24/98	Wednesday	56	1	82	19.57	Unknown	Unknown
6/25/98	Thursday	57	0	82	19.57	0	Not Applicable
6/26/98	Friday	58	1	83	19.81	Unknown	Unknown
6/29/98	Monday	61	2	85	20.29	Unknown	Unknown
7/3/98	Friday	65	2	87	20.76	Unknown	Unknown
7/6/98	Monday	68	1	88	21.00	Unknown	Unknown
7/7/98	Tuesday	69	0	88	21.00	Unknown	Unknown
7/8/98	Wednesday	70	1	89	21.24	Unknown	Unknown
7/14/98	Tuesday	76	1	90	21.48	Unknown	Unknown
8/10/98	Monday	103	1	91	21.72	Unknown	Unknown
8/14/98	Friday	107	5	96	22.91	Unknown	Unknown
Total Pre-Surveys Mailed			422	Total Postage		\$49.76	
				Average Cost Per Survey		\$0.52	

Note 1. 422 surveys mailed on 4/30/98 to Alameda

Note 2. 3 surveys returned - wrong address.

Note 3. Postcard mailed 5/13/98.

Note 4. Cost is "unknown" because these surveys arrived with surveys from other cities.

As a result of the pre-survey some questions were refined or added. The option of “No garage or detached” was added to the question regarding the strengthening of the garage door opening (#6c). The direction to “Circle the one most important reason” was added to the questions on why the owner had decided to retrofit or not retrofit the home (#7 and #14). Respondents seemed to be confused by what was meant by “risk in their neighborhood” in these questions as well (#7e and #14c), so we changed the wording of those answers slightly to improve clarity. One of the answers to the question asking how the owner paid for the work was changed to read “Cash or credit card” (#11), because the previous answer, “Cash,” seemed to confuse respondents.

Lastly, a question was added about the owner’s age (#J). This was done because we believed at times a low income might be related to age, as is the case with retired homeowners. These homeowners would be classified in a different demographic than those that have a small income but are currently working. As a result, we wanted to be able to identify each. Additionally, the age of the homeowner would likely have an effect on how long the homeowner has lived in the home.

SURVEY MAIL-OUT AND RESPONSE RATES

Overall, a total of 1,755 of the 6,336 surveys with valid addresses, or over 27.7%, were completed and returned as of September 18, 1998.³ In the three month period following the survey mail-out in mid June 1998, the post office returned 194 because of invalid addresses. Twenty-eight were returned by the homeowner, but left unanswered. This is a remarkable response rate for a complex mailed questionnaire (refer to TABLE A3 – *Bay Area Earthquake Safety Survey*).

TABLE A3 – Returned Bay Area Earthquake Safety Surveys^{1,2,3}

Date	Day	Day #	# Surveys	Total #	Total %	\$ Cost	Cost/Survey	Subtotal
pre-6/19 (Alameda)			80					
6/19/98 Friday		3	13	13	0.2	6.36	0.49	6.36
6/22/98 Monday		6	172	185	3.0	73.92	0.43	80.28
6/23/98 Tuesday		7	125	310	5.1	53.44	0.43	133.72
6/24/98 Wednesday		8	194	504	8.2	83.66	0.43	217.38
6/25/98 Thursday		9	46	550	9.0	20.04	0.44	237.42
6/26/98 Friday		10	44	594	9.7	18.89	0.43	256.31
6/29/98 Monday		13	63	657	10.7	27.06	0.43	283.37
6/30/98 Tuesday		14	15	672	11.0	6.60	0.44	289.97
7/1/98 Wednesday		15	40	712	11.6	16.80	0.42	306.77
7/2/98 Thursday		16	19	731	11.9	7.98	0.42	314.75
7/3/98 Friday		17	11	742	12.1	4.62	0.42	319.37
7/6/98 Monday		20	16	758	12.4	6.72	0.42	326.09
7/7/98 Tuesday		21	16	774	12.6	6.30	0.39	332.39
7/8/98 Wednesday		22	17	791	12.9	7.02	0.41	339.41
7/9/98 Thursday		23	18	809	13.2	7.14	0.40	346.55
7/10/98 Friday		24	34	843	13.7	13.44	0.40	359.99
7/13/98 Monday		27	56	899	14.7	23.94	0.43	383.93
7/14/98 Tuesday		28	13	912	14.9	5.04	0.39	388.97
7/15/98 Wednesday		29	29	941	15.3	11.34	0.39	400.31
7/16/98 Thursday		30	23	964	15.7	9.66	0.42	409.97
7/17/98 Friday		31	10	974	15.9	4.20	0.42	414.17
7/20/98 Monday		34	25	999	16.3	10.42	0.42	424.59
7/21/98 Tuesday		35	16	1,015	16.5	7.56	0.47	432.15
7/22/98 Wednesday		36	3	1,018	16.6	1.26	0.42	433.41
7/23/98 Thursday		37	11	1,029	16.8	4.62	0.42	438.03
7/24/98 Friday		38	4	1,033	16.8	1.68	0.42	439.71
7/27/98 Monday		41	12	1,045	17.0	5.04	0.42	444.75
7/28/98 Tuesday		42	5	1,050	17.1	2.10	0.42	446.85
7/29/98 Wednesday		43	12	1,062	17.3	5.88	0.49	452.73
7/30/98 Thursday		44	6	1,068	17.4	2.10	0.35	454.83
7/31/98 Friday		45	4	1,152	18.8	2.10	0.53	456.93

(Responses continued on next page)

³ A pre-survey was mailed to Alameda homeowners on April 30, 1998.

TABLE A3 – Returned Bay Area Earthquake Safety Surveys (continued)

Date	Day	Day #	# Surveys	Total #	Total %	\$ Cost	Cost/Survey	Subtotal
8/3/98	Monday	48	22	1,174	19.1	9.14	0.42	466.07
8/4/98	Tuesday	49	10	1,184	19.3	4.20	0.42	470.27
8/5/98	Wednesday	50	28	1,212	19.8	11.76	0.42	482.03
8/6/98	Thursday	51	13	1,225	20.0	5.88	0.45	487.91
8/7/98	Friday	52	7	1,232	20.1	2.94	0.42	490.85
8/10/98	Monday	55	19	1,251	20.4	8.40	0.44	499.25
8/11/98	Tuesday	56	7	1,258	20.5	3.36	0.48	502.61
8/12/98	Wednesday	57	7	1,265	20.6	4.20	0.60	506.81
8/13/98	Thursday	58	6	1,271	20.7	2.52	0.42	509.33
8/14/98	Friday	59	21	1,292	21.1	9.24	0.44	518.57
8/17/98	Monday	62	118	1,410	23.0	48.80	0.41	567.37
8/18/98	Tuesday	63	40	1,450	23.6	17.22	0.43	584.59
8/19/98	Wednesday	64	53	1,503	24.5	23.94	0.45	608.53
8/20/98	Thursday	65	25	1,528	24.9	10.50	0.42	619.03
8/21/98	Friday	66	19	1,547	25.2	9.24	0.49	628.27
8/24/98	Monday	69	50	1,597	26.0	23.10	0.46	651.37
8/25/98	Tuesday	70	13	1,610	26.2	5.46	0.42	656.83
8/26/98	Wednesday	71	18	1,628	26.5	7.98	0.44	664.81
8/27/98	Thursday	72	20	1,648	26.9	8.40	0.42	673.21
8/28/98	Friday	73	24	1,672	27.2	10.42	0.43	683.63
8/31/98	Monday	76	9	1,681	27.4	3.78	0.42	687.41
9/1/98	Tuesday	77	9	1,690	27.5	3.36	0.37	690.77
9/2/98	Wednesday	78	9	1,699	27.7	3.78	0.42	694.55
9/3/98	Thursday	79	8	1,707	27.8	3.78	0.47	698.33
9/4/98	Friday	80	6	1,713	27.9	2.94	0.49	701.27
9/8/98	Tuesday	84	14	1,727	28.1	6.30	0.45	707.57
9/9/98	Wednesday	85	2	1,729	28.2	0.84	0.42	708.41
9/10/98	Thursday	86	10	1,739	28.3	5.04	0.50	713.45
9/11/98	Friday	87	6	1,745	28.4	2.94	0.49	716.39
9/14/98	Monday	90	3	1,748	28.5	1.68	0.56	718.07
9/15/98	Tuesday	91	1	1,749	28.5	0.42	0.42	718.49
9/16/98	Wednesday	92	2	1,751	28.5	1.26	0.63	719.75
9/17/98	Thursday	93	2	1,753	28.6	0.84	0.42	720.59
9/18/98	Friday	94	2	1,755	28.6	0.84	0.42	721.43
Total Surveys Mailed			6,336	Total Postage		\$721.43		
				Average Cost Per Survey		\$0.41		

Note 1. 6,136 surveys mailed on 6/16/98 to 16 jurisdictions (not including Alameda).

Note 2. After sending reminder postcards, completed surveys began to be received by ABAG as of July 9, 1998. Completed second copies of the survey began to be received by ABAG as of July 31, 1998. After sending additional postcards to Napa and Richmond, ABAG began to receive completed surveys began as of August 17, 1998.

Note 3. "Total Surveys" has been adjusted to not count surveys with invalid addresses or those returned completely unanswered.

Looking only at those surveys sent out with valid addresses, the initial survey mail-out yielded 845 responses, with 13.3% of the total homeowners responding. A follow-up reminder postcard was sent two weeks later to homeowners who had not responded. As a result 334 additional completed surveys were received in the following weeks, with a total of 18.6% of the homeowners responding as a result of the survey and the postcard. ABAG received many phone calls after the postcards were mailed, asking for another survey to be sent out. Additionally, several people opted to take the survey over the phone while an ABAG employee read the questions.

A second copy of the survey was mailed out in August 1998. A small sticker was added to the envelope that stated “Earthquake Safety Program Please answer our survey!” In the 2-3 weeks that followed, additional postcards were sent to Richmond and Napa, two cities with particularly low response rates. The mayor’s offices in these cities agreed to allow us to state on these postcards that responding to the survey would be helpful to the city at large. Of these second surveys, 576 were completed and returned, adding up to a total of 27.7% of the homeowners responding with completed surveys as a result of *all* the mailings undertaken in the course of the survey mail-out process.

These additional three mailings after the initial survey mail-out were efforts to boost the response rate to a level that would be high enough to yield statistically valid calculations and draw conclusions from the data. Also, we wanted to gain additional responses from less educated and lower-income homeowners; this demographic did not respond in high numbers to the original survey mail-out.

A “Thank You Flier” has been sent to all homeowners returning the survey. It includes suggestions on how to seismically retrofit homes and prepare for earthquakes.

SURVEY PROCEDURES AFTER MAIL-OUT

Problematic Surveys

A total of 194 surveys were “bounced back” by the post office because the mailing addresses were incorrect or because the homeowner had moved. When possible, we attempted to seek out the homeowner’s new address in order to send out a new questionnaire.

Additionally, 10 surveys were received completed but with the site address torn off. These were placed into the “other” category for city, since we could no longer tell in what city the home was located. These homeowners often believed that our organization was going to try to “sell them something.” Others simply wanted to protect their privacy, or be able to give hostile responses without being identified.

Another group of 28 surveys arrived that were unusable, and subtracted from the total number of surveys sent out so that they wouldn’t have an effect on the response rates. These are surveys that were returned completely unanswered, many with the label torn off entirely. A few were answered for the wrong house. Others were blank with no explanation. Many, however, had hostile comments and some colorful language written across the survey such as “No junk mail!” or “Where were you when we needed help?”

Language Hotline

We believed that responses and feedback from homeowners that were not proficient in English were important as well. We offered an option to Spanish, Cantonese, and Mandarin speakers to call ABAG's "language hotline" to have someone call them back and ask them the survey questions in their language. We received four such calls: two in Spanish and one in each of the Chinese dialects. Those calling the hotline were pleased that this option was offered because they were not comfortable filling out the form in English.

Of the non-English speaking callers, most were forthcoming with their answers and happy to help. One, however, was helpful but didn't want to be bothered in the future; he had felt obligated to wait by the phone for several days until we returned his call. For the most part, the callers were concerned with earthquake safety but hadn't taken structural measures. One homeowner had some nonstructural work completed, while another had purchased earthquake insurance. The Cantonese speaking caller wanted to seismically strengthen his home, but did not trust contractors. He believed that there was no one close enough to him to trust. This situation was not so much a problem of distrust due to the language barrier, but could be better attributed to simply not knowing people who had previous had seismic work performed on their homes. For the most part, the responses on the multi-lingual phone line were not that different from the total responses.

RESPONSE RATES

BY JURISDICTION

While the total response rate for the survey was 27.7%, a high number considering the complexity of retrofit questions asked, the response rate for individual jurisdictions ranged between 21.0% and 40.8%. Berkeley had the highest response rate with 40.8% of homeowners returning the survey, followed by Palo Alto with 35.6%. On the other end of the spectrum, Santa Clara retained the lowest response rate at 21.0%, followed by Napa at 22.0% (refer to TABLE A4 – *Response Rate by City*). The response rate was high enough for each city to make the results statistically valid. However, the number of completed surveys that were received for the unincorporated areas was not high enough for the individual areas to make them statistically valid. As a result, in order to obtain statistically valid results, we grouped the jurisdictions of Ashland-San Lorenzo, Crockett, and Lexington Hills together into "Unincorporated Areas" for the remainder of the study.

TABLE A4 – Response Rate by City^{1,2,3}

<i>Jurisdiction</i>	<i>Total Completed Surveys</i>	<i>Total Mailed</i>	<i># Problematic Surveys</i>	<i>Percentage Returned</i>
Alameda	118	422	7	28.4%
Ashland-San Lorenzo	42	185	7	23.6%
Berkeley	180	450	9	40.8%
Concord	108	460	31	25.2%
Crockett	32	102	4	32.7%
Daly City	107	383	10	28.7%
Lexington Hills	30	120	9	27.0%
Los Gatos	45	143	4	32.4%
Napa	78	365	11	22.0%
Oakland	144	557	23	27.0%
Palo Alto	162	466	11	35.6%
Richmond	101	428	19	24.7%
San Francisco	163	729	22	23.1%
San Jose	152	575	20	27.4%
San Leandro	108	470	13	23.6%
Santa Clara	65	315	6	21.0%
Santa Rosa	110	388	16	29.6%
Other	10	--	0	--
<i>Unincorporated Areas</i>	<i>104</i>	<i>407</i>	<i>20</i>	<i>26.9%</i>
<i>Cities</i>	<i>1641</i>	<i>6151</i>	<i>202</i>	<i>27.6%</i>
Total	1,755	6,558	222	27.7%

Note 1. "Number of problematic surveys" is the number of surveys which were "bounced back" by the post office because the mailing addresses were incorrect or because the homeowner had moved. It also includes the number of surveys that were returned completely unanswered. This total number was subtracted from the "Total Mailed" number to make the response rate more accurate.

Note 2. Light shading indicates the highest response rates; dark shading indicates the lowest.

Note 3. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills is included in "Unincorporated Areas."

BY CENSUS TRACT

The response rate by census tract varied widely between 6.0% for the western Fruitvale neighborhood in Oakland, to 52.5% for the western Gourmet Ghetto area of Berkeley. The census tracts with the highest response rates were located in northern and western Berkeley, the Piedmont Avenue and Montclair neighborhoods of Oakland, southern and northwestern Palo Alto, San Francisco's Richmond District, and south-central San Jose. In contrast, the census tracts with the lowest response rates were located in northern and southeastern Oakland, southern Richmond, the Bay View and Crocker Amazon neighborhoods of San Francisco, and in various tracts in San Jose, San Leandro, and Santa Clara. Oakland was especially diverse with five of seven tracts in either the ten lowest or the ten highest response rate categories of those census tracts studied (refer to TABLE A5 – *Response Rate by Census Tract*).

TABLE A5 — Response Rate by Census Tract^{1,2,3}

# Responding	# Surveys Sent	# Problem Surveys	Response Rate	City Tracts	Location of Tract
118	422	7	28.4%	Alameda	
34	109	1	31.5%	4271.00	Fernside; NE edge of Alameda; NE of Lincoln
13	56	1	23.6%	4272.00	NE Alameda; On Tidal Canal; N of Park & Lincoln
18	58	1	31.6%	4277.00	S Alameda; On SF Bay & USN border; W of Webster
17	71	2	24.6%	4278.00	Central Alameda; SE of Webster & Lincoln
36	128	2	28.6%	4282.00	SE edge of Alameda; S of Park & Encinal
42	185	7	23.6%	Ashland-San Lorenzo	
21	98	6	22.8%	4340.00	Ashland; NW of I-580 & I-238 interchange
21	87	1	24.4%	4358.00	San Lorenzo; On San Leandro border west of I-880
180	450	9	40.8%	Berkeley	
59	130	1	45.7%	4212.00	Thousand Oaks; on fault; near Cragmont School
31	59	0	52.5%	4218.00	W of Gourmet Ghetto; Between MLK & Sacramento
37	92	1	40.7%	4219.00	Westbrae; On Albany border; BART line
16	50	1	32.7%	4221.00	Ocean View; NW of University & San Pablo
24	59	2	42.1%	4222.00	W Berkeley; NE of University & San Pablo
13	60	4	23.2%	4240.00	SW Berkeley; On Oakland border; SW of Ashby & MLK
108	460	31	25.2%	Concord	
31	123	10	27.4%	3290.00	N edge of Concord; S of Hwy 4
30	139	9	23.1%	3300.00	N Concord; NW of Port Chicago Hwy & Willow Pass
27	100	6	28.7%	3310.00	N central Concord; E of downtown; SE of Willow Pass
20	98	6	21.7%	3362.00	W central Concord; Next to Pleasant Hill; E of Hwy 242
32	102	4	32.7%	Crockett	
32	102	4	32.7%	3570.00	All of Crockett; includes Port Costa

TABLE A5 — Response Rate by Census Tract (continued)

# Responding	# Surveys Sent	# Problem Surveys	Response Rate	City Tracts	Location of Tract
107	383	10	28.7%	Daly City	
87	309	8	28.9%	6009.00	NW edge of Daly City; Next to SF; N of John Daly Blvd.
20	74	2	27.8%	6011.00	W Daly City; W of Broadmoor Village; E of Hwy 35
30	120	9	27.0%	Lexington Hills	
30	120	9	27.0%	5118.98	Large tract on county line; Includes Redwood Estates
45	143	4	32.4%	Los Gatos	
37	116	4	33.0%	5070.00	S edge of Los Gatos; SE of Hwy 17 & 9 interchange
8	27	0	29.6%	5071.00	W edge of Los Gatos; Next to Monte Sereno; W of 17
78	365	11	22.0%	Napa	
32	146	7	23.0%	2002.00	S Napa; E of Hwy 29 between 1st St. & Imola Ave.
19	71	0	26.8%	2004.00	E. Napa; W of 1st Ave. between Hagen & Coombsville
27	148	4	18.8%	2005.00	Central Napa; E of Hwy 29 between Trancas & 1st St.
144	557	23	27.0%	Oakland	
8	60	3	14.0%	4007.00	N Oakland; On Berkeley border; N of 52nd
20	56	2	37.0%	4041.00	Piedmont Ave.; NE of Broadway & 40th
28	79	0	35.4%	4042.00	Upper Rockridge; Includes cemetery; W of Hwy 13
48	130	6	38.7%	4045.02	Montclair; E of Hwy 13 & Thornhill Dr
3	50	0	6.0%	4061.00	W Fruitvale; On Alameda border; W of E 14th & High
25	99	6	26.9%	4068.00	Redwood Heights; Between Hwy 13 & MacArthur
12	83	6	15.6%	4104.00	SE Oakland; On San Leandro border; E of E 14th
162	466	11	35.6%	Palo Alto	
36	89	2	41.4%	5106.00	Far S Palo Alto; Next to Los Altos; SW of El Cam. Real
34	94	2	37.0%	5111.00	NW Palo Alto; On E Palo Alto border; SW of Hwy 101
36	113	4	33.0%	5112.00	N Palo Alto; Next to Menlo Park/E Palo Alto
20	68	2	30.3%	5113.98	Far NW Palo Alto; Next to Menlo Park; SW of Middlefield
36	102	1	35.6%	5114.98	Central Palo Alto; N of Oregon Exwy & Alma St.

TABLE A5 — Response Rate by Census Tract (continued)

# Responding	# Surveys Sent	# Problem Surveys	Response Rate	City Tracts	Location of Tract
101	428	19	24.7%	Richmond	
32	109	3	30.2%	3710.00	NE Richmond; Next to San Pablo; NW of I-80 & MacDnld
53	166	7	33.3%	3720.00	Far N centr. Richmond; On San Pablo border; E of 23rd
10	80	6	13.5%	3790.00	SW central Richmond; NW of Cutting Blvd. & Carlson
6	73	3	8.6%	3810.00	S central Richmond; NW of I-80 & Cutting Blvd.
163	729	22	23.1%	San Francisco	
13	49	1	27.1%	132.00	Pacific Heights; Next to Presidio; Betw. Lyon & Laguna
12	52	2	24.0%	133.00	Presidio Heights; Next to Presidio; North of California
6	25	0	24.0%	205.00	Eureka Valley; Betw. 17th & 21st, Castro & Douglass
19	57	3	35.2%	218.00	Glen Park; W of San Jose Ave. betw. 30th & Bosworth
9	48	0	18.8%	229.00	Mission District; Between Hwy. 101 & S Van Ness
6	40	2	15.8%	234.00	Bay View; On Candlestick Park boundary; SE of 3rd
13	78	2	17.1%	257.00	Portola/Silver Terrace; SW of I-280 & Hwy 101
7	60	3	12.3%	263.00	Crocker Amazon; Next to Daly City; SE of Mission
16	79	2	20.8%	308.00	West Portal; E of 19th between Taraval & San Francis
16	65	1	25.0%	309.00	Ingleside Terrace/Balboa Terrace; E of 19th Ave.
15	62	1	24.6%	327.00	Sunset; On Golden Gate Park; Betw. Sunset & 28th
11	60	2	19.0%	428.00	Seacliff; On Presidio & Pac. Ocean; NE of Calif. & 32nd
20	54	3	39.2%	478.00	Richmond; Between Fulton & Clement, 29th & 38th
152	575	20	27.4%	San Jose	
32	131	5	25.4%	5005.00	W of Downtown SJ; Near Santa Clara; SE of I-880
24	78	2	31.6%	5006.00	W of Downtown San Jose; E of Park & Naglee
26	116	4	23.2%	5011.00	N central SJ; Mile+ N of downtown; SE of E Taylor
10	48	0	20.8%	5015.00	Central San Jose; Mile+ east of downtown; SW of 101
7	46	0	15.2%	5016.00	SE of Downtown San Jose; E of S 1st & E William
53	156	9	36.1%	5024.00	Central San Jose; Mile 1/2 S of downtown; W of 87

TABLE A5 — Response Rate by Census Tract (continued)

# Responding	# Surveys Sent	# Problem Surveys	Response Rate	City Tracts	Location of Tract
108	470	13	23.6%	San Leandro	
22	77	3	29.7%	4322.00	N edge of San Leandro; Next to Oakland; E of E 14th
13	86	2	15.5%	4323.00	N edge of San Leandro; Next to Oakland; W of E 14th
32	176	1	18.3%	4325.00	NW San Leandro; Next to Oakland; N of I-880 & Marina
18	55	3	34.6%	4326.00	N SL; Next to Oakland; NW of Bancroft & Sybil
23	76	4	31.9%	4327.00	NE San Leandro; Near Oakland; Betw. I-580 & Bancroft
65	315	6	21.0%	Santa Clara	
17	101	2	17.2%	5053.04	W central Santa Clara; Betw. Monroe & El Camino Real
33	123	0	26.8%	5053.05	Far W SC; Next to Sunnyvale; N of El Camino Real
5	24	2	22.7%	5056.00	Downtown; Includes Mission & Univ.; S of El Cam. Real
10	67	2	15.4%	5057.00	Far E Santa Clara; Next to San Jose; E of Winchester
110	388	16	29.6%	Santa Rosa	
54	161	4	34.4%	1518.00	S central Santa Rosa; E of downtown; N of Hwy 12
13	51	3	27.1%	1519.00	S central Santa Rosa; S of downtown; SE of 101
37	139	6	27.8%	1522.00	Cent. Santa Rosa; N of dwntwn; NE of Mendocino
6	37	3	17.6%	1530.02	SW Santa Rosa; W of downtown; SW of 101 & College
10	--	0	--	Other	Arrived with site address torn off survey
104	407	20	26.9%	Unincorporated Areas	Ashland-San Lorenzo, Crockett, and Lexington Hills
1641	6151	202	27.6%	Cities	All other jurisdictions
1755	6558	222	27.7%	Total	All jurisdictions

Note 1. "Problem surveys" included surveys that were "bounced back" by the post office because of a problem with the mailing address, and surveys that were returned completely unanswered.

Note 2. The response rate was calculated with the formula: (# Responding)/(#Surveys Sent - # Problem Surveys).

Note 3. Tracts with the highest response rates are indicated with light shading, while those with the lowest response rates are indicated with dark shading.

RESPONSE RATE SKEWING

The returned questionnaires were likely to over-represent those who have retrofitted. It seems reasonable that more people who have retrofitted would respond to our survey, since it is a subject that would interest them more. Moreover, the survey would give them the opportunity to brag, in a sense, about the retrofit work they had completed.

In a separate ABAG initiated project, the American Society of Home Inspectors (ASHI) conducted an inspection of homes that were for sale. ASHI inspectors answered the ABAG survey questions based on their assessment of the construction and extent of seismic retrofit of each dwelling. These surveys were primarily conducted in the East Bay, especially in Oakland, Berkeley, and Alameda. We were able to use this data to compare the retrofit rate from ASHI, which we expected to be closer to the actual retrofit rate, and the retrofit rate from the homeowner survey, which may have over-represented those who retrofitted (see Technical Appendix B).

We did not weigh the importance of individual tracts in calculating city retrofit rates throughout the survey because determining these rates was not the central goal of the survey. We realized from the beginning that these results would be skewed. Instead, we were more interested in why homeowners retrofit, and retrofit rates of cities relative to each other.

Additionally, the returned questionnaires are likely to over-represent those with higher income and educational attainment. We consulted educational attainment and income information from the census to compare the respondents with average homeowners in the census tracts.

Both of these problems were alleviated to some extent by increasing the response rate through the third and fourth mailings. The later respondents included homeowners that were less educated and had lower incomes. In addition, after the reminder postcard was mailed out, the rate of those acting to at least partially retrofit decreased, and after the second survey was mailed out the rate then decreased only slightly. As we received more total responses we probably lessened the skewing and approached the actual rate of homeowners acting to at least partially retrofit.

Also, some homeowners reported that their homes were built later than 1960. This discrepancy is most likely due to an error on the homeowners' part because these numbers were self-reported and likely not as accurate as the assessor's data that we used to create the sample. Because this problem seemed to occur randomly across the chosen cities, and not in a few particular cities, its effect on the survey results should be negligible.

TOTAL SAMPLE RESULTS

RETROFITTING DEFINITION

We created several definitions of retrofit so as to examine all the structural measures together. In addition, it is useful to keep in mind that cities and neighborhoods are not homogenous with regards to when bolting began in buildings. Who built the homes and what they knew about earthquakes varied considerably by city and neighborhood. For instance, when local building

departments and contractors in a particular area became aware of earthquake issues played a major role in when bolting began. For the purposes of this study we will assume that in general, homes built before 1950 were not bolted because this work was not required until about 1950. However, it *is* possible that this retrofit work had been done in homes in the previous decades.

At Least Partially Retrofitted

We defined homes that had been retrofitted in some way by a previous owner or by the current owner as at least partially retrofitted. Because houses built in or after 1950 were *required* to have the foundation bolting, we did not count these homes as partially retrofitted if the only work indicated was bolting. (We assumed the bolting was part of the original home construction.) On the other hand, if the current owner had acted to bolt the home, we assumed that additional bolts were added, even for more recently built homes. Thus, these homes are included in the partially retrofitted category. Other forms of structural retrofit, which were always counted in the retrofit definition, included plywood added to the crawl space or a strengthened garage door opening. Additionally, we generally assumed that leaving answers blank meant that no retrofit had taken place.

Full (or Reasonably Complete) Retrofit

Determining when a full or reasonable complete retrofit had taken place was a more difficult task. Our primary definition of reasonably complete retrofit stated that either the previous or current owner must have had foundation bolting and plywood added to the crawlspace unless there was no crawlspace or it was inaccessible.⁴ Whether or not the home had a reasonably complete retrofit was ascertained through this definition for a large majority of cases. Similarly in the 131 cases when the respondent stated that no bolts had been installed, and plywood had been added to the crawlspace or the home lacked or had an inaccessible crawlspace, it was determined that these homes did not have reasonably complete retrofits.

In defining whether or not a reasonably complete retrofit had taken place, there were 27 cases in which the respondent left no answer as to whether foundation bolting had occurred, but stated that plywood had indeed been added to the crawlspace. These were judgment calls in determining whether or not a reasonably complete retrofit had taken place, looking primarily at the responses to survey questions regarding structural retrofit measures, the year in which the home was built, and whether or not a structural engineer or the City had been consulted. Looking at these responses we attempted to diagnose whether a reasonably complete retrofit had taken place using a consistent formula for each event. We attempted to go the conservative route – we could have given more cases credit for reasonably complete retrofits than we did.

In the first event, plywood had been added by a previous owner, and the answer for bolts was left blank. In executing a retrofit, bolting the foundation is the most common action taken to retrofit the home and is usually done first. We believed that since the previous homeowner had taken care of the retrofit task of adding plywood, it was likely that bolts had been previously added as well without the current owner being the wiser.

⁴ It was assumed that if the respondent did not answer the plywood question, that structural measures had not been taken.

In the second event, the current homeowner had added plywood and the question for bolts was left blank. We made judgment calls by looking at the individual cases in this event. We determined in six cases that a reasonably complete retrofit had taken place. This occurred when the home had the preceding survey responses in addition to any of the following: the home was built in the 1950s; the respondent had consulted an engineer; the respondent had consulted the City for retrofit assistance; the home was built in the 1920s, located in Lexington Hills, and had survived the Loma Prieta earthquake. In the one case when we determined that a reasonably complete retrofit had not taken place, the home was built before the 1950s and there was no evidence that an engineer or other source had been consulted.

In the third event, the home had no crawlspace or it was inaccessible, and the question for bolts was left blank. In only one of these 16 cases did we give the home credit for being a reasonably complete retrofit. The one reasonably complete retrofit that we established was because the garage had also been structurally retrofitted and the respondent had hired an engineer.

Because of the differences in definition between partial and reasonably complete retrofits, it is possible that a home was defined as a reasonably complete retrofit but not defined as at least partially retrofitted. For the most part this discrepancy occurred when a home built in or after 1950 had foundation bolting but no plywood. This is because we determined that if there was no crawlspace or if it was inaccessible, but bolts had been installed, the retrofit was reasonably complete and therefore constituted a reasonably complete retrofit. Additionally, to be defined as a partial retrofit, such a home built in 1950 or after must have had plywood added to the crawlspace. If the home didn't have plywood in the crawlspace because of the lack of or inaccessibility of a crawlspace, then the home was defined as *not* partially retrofitted despite being determined a reasonably complete retrofit.

For the most part this discrepancy occurred when all of the following conditions were met: the home was built in or after 1950 and didn't have plywood in the crawlspace because of the lack of or inaccessibility of a crawlspace. In this case the home was determined to be a reasonably complete retrofit as well as *not* partially retrofitted.

Acting to at Least Partially Retrofit

Acting to at least partially retrofit was defined as the current owner taking at least one of the three structural measures mentioned in the survey (foundation bolting, adding plywood to the crawlspace, or strengthening the garage door opening). If answers were left blank it was assumed that the structural measure had not been taken.

Retrofit Before Purchase by Current Owner

We determined that the home had been retrofitted by a previous owner if bolts had been installed in a home built before 1950 by the previous owner. Additionally, the home was also defined as retrofitted before being purchased by the current owner if plywood had been added to the crawlspace or the garage door opening had been strengthened by the previous owner regardless of the year the home was built.

STRUCTURAL MEASURES

Bolting to the foundation had occurred in 65.3% of homes. Of all homeowners, 27.5% had acted to do this work since they bought the home. Plywood had been added in the crawl space in 25.0% of homes, with 18.7% of homeowners getting this work done since they became the owner. Also, 16.6% of homes had a strengthened garage door opening. The current homeowner had acted to take care of this measure in 12.9% of all homes.

Citing our previous definition of retrofit, we calculated the structural retrofit rates of homeowners. The home had been at least partially retrofitted in some way in 60.1% of homes, and had a reasonably complete retrofit in 33.5% – in both cases before or since the current owner. The survey found that 37.9% of homeowners had personally acted in some way to at least partially retrofit the home, while 28.4% of homes had been retrofitted in some way before being purchased by the current owner.⁵

The most common reason cited for not taking care of structural work was “I don’t know what I need to do,” mentioned by 42.8% of respondents. Second most common, with 37.8%, was “I think it costs too much for me to do,” followed by the third most common response, “I haven’t gotten around to it,” cited by 26.9% of homeowners.

On the other hand, the most commonly cited reason for *doing* the structural work was, “I wanted to feel safer,” which 55.9% of respondents mentioned. “I am concerned about damaging earthquakes in this home’s neighborhood” was the next most common response, given by 54.5% of respondents. “Other” was third most common, with 27.7% of respondents – many stating that the structural work had been completed as part of a larger remodel of the home. Only 4.7% of respondents stated that they decided to do the structural work because of the City or County. Of these respondents, 10 lived in Berkeley, 6 in San Leandro, and another 11 were scattered throughout other jurisdictions.

Prior earthquake strengthening did not seem to be a large factor in the decision to purchase the home. When asked if it was a factor, 26.7% stated “Not at all,” while only 4.2% stated “Yes, a lot.” In getting the retrofit work done, 67.2% of homeowners hired a contractor, 16.8% did all the work themselves, and the remaining 16.1% did some of the work themselves *and* also hired a contractor. In paying for the work, 75.7% of respondents paid with cash or credit card, 26.6% paid through a loan or refinance, and only 2.8% were supported through a government program.⁶

Bracing or strapping the water heater was the most common nonstructural measure taken, having been taken care of in 78.8% of homes. The current owners took this measure in 57.5% of all homes. The survey found that 20.9% of homes had braced chimneys, and in 11.0% of homes the work had been done since the current owner had purchased the home. Only 12.0% of respondents owned a home in which a special gas shut-off valve triggered by shaking or a gas leak detector had been installed. Of the current owners, 8.1% had taken care of this work

⁵ These two numbers do not add up to 60.1% because a number of respondents stated that there had been work to retrofit their home both before *and* after it was purchased.

⁶ The sum of these is more than 100% because some people paid for the retrofit in more than one way.

themselves. Overall, we calculated that 81.8% of respondents lived in homes in which some nonstructural measures had been taken by either the previous or current homeowner.

DEMOGRAPHICS AND OTHER RESPONDENT CHARACTERISTICS

58.6% of respondents lived in their present homes in 1989 when the Loma Prieta earthquake occurred. Looking at risk perception, 55.8% of survey respondents believed that there was a very to moderately high risk of a major earthquake in their home's neighborhood, while 44.2% believed there was a very to moderately low risk. Knowing someone who had done additional structural work on their home was true for 34.9% of respondents.

Living in, as opposed to renting, the home that the survey targeted was true of 87.1% of respondents. Additionally, 48.2% of homeowners had never purchased earthquake insurance for the home, while 29.2% had purchased this insurance, and 22.6% of homeowners used to possess it.

Of the homeowners who returned the questionnaire, 66.9% had graduated from college, 28.0% had graduated from high school but not college, and 5.1% had not graduated from high school. The overall educational attainment was .809.⁷ Looking at age, only 7.8% of respondents were younger than 35, 62.5% were between the ages of 35 and 64, and 29.8% were older than 65. The mean family income of respondents was calculated to be \$64,745⁸ (Refer to TABLE A6 – *Responses to Questions*).

TABLE A6 – Responses to Questions

For purposes of simplicity we've aggregated all responses to the survey in this table. However, the percentages are not indicative of Bay Area averages but rather the percentages of those responding to the homeowner survey.

Part 1

1. How many stories high is this home (above ground, including parking)

	<i># of Respondents</i>	<i>% of Respondents</i>
1 story (includes 1.5 stories)	984	57.3%
2 stories (includes 2.5 stories)	582	33.9%
3+ stories	150	8.7%

2. Is there living area (office, bedrooms, living room, etc.) above a garage?

Yes	507	29.3%
No	1224	70.7%

⁷The score for educational attainment was determined by using the formula: ((# didn't finish high school)*0 + (# high school graduates)*.5 + (#college graduates)*1)/(total # of respondents).

⁸ The mean household income was calculated from the survey data through the following formula: [(# with income under \$20,000)*\$15,000 + (# with income \$20-\$40,000)*\$30,000 + (# with income \$40-\$60,000)*\$50,000 + (# with income \$60-\$80,000)*\$70,000 + (# with income \$80-\$100,000)*\$90,000 + (#with income over \$100,000)*\$110,000]/(# of respondents).

TABLE A6 – Responses to Questions (continued)

3. What is the approximate decade this home was originally built?

(The question was open-ended. We sorted the data into categories.)

<1900	42	2.5%
1900-1909	82	4.9%
1910-1919	115	6.9%
1920-1929	333	19.9%
1930-1939	229	13.7%
1940-1949	382	22.8%
1950+	494	29.5%

4. Has this home been substantially changed with a major renovation?

Yes	646	37.8%
No	1064	62.2%

5. Which of the following precautions have been taken for this home, and when did they occur?

These are called **nonstructural** measures.

a. The water heater is braced or strapped to the wall?

Yes, before I bought the home	373	21.3%
Yes, after I bought the home	997	56.8%
No	341	19.4%
(Answered Yes to before home bought AND after home bought)	13	.7%
(Doesn't know or no response)	31	1.8%

b. The chimney(s) is braced?

Yes, before I bought the home	174	9.9%
Yes, after I bought the home	189	10.8%
No chimneys	370	21.1%
No	902	51.4%
(Answered Yes to before home bought AND after home bought)	3	.2%
(Doesn't know or no response)	117	6.7%

c. A special gas shut-off valve triggered by shaking or a gas leak detector is installed?

Yes, before I bought the home	69	3.9%
Yes, after I bought the home	140	8.0%
No	1376	78.4%
(Answered Yes to before home bought AND after home bought)	2	.1%
(Doesn't know or no response)	168	9.6%

TABLE A6 – Responses to Questions (continued)

Overall, we calculated whether *any* nonstructural measures had been taken by the previous or current owner:

Nonstructural measures were taken for this home	1435	81.8%
No nonstructural measures were taken for this home or doesn't know	320	18.2%

6. Which of the following **structural** measures have been taken for your home, and when did they occur?

d. The home is bolted to its foundation?

Yes, before I bought the home	663	37.8%
Yes, after I bought the home	460	26.2%
No	506	28.8%
(Answered Yes to before home bought AND after home bought)	23	1.3%
(Doesn't know or no response)	103	5.9%

e. Plywood has been added in the crawl space?

Yes, before I bought the home	111	6.3%
Yes, after I bought the home	323	18.4%
No crawl space	297	16.9%
No	902	51.4%
(Answered Yes to before home bought AND after home bought)	6	.3%
(Doesn't know or no response)	116	6.6%

f. Additional strengthening of the garage door opening has occurred?

Yes, before I bought the home	65	3.7%
Yes, after I bought the home	227	12.9%
No garage or detached	524	29.9%
No	845	48.1%
(Answered Yes to before home bought AND after home bought)	0	0.0%
(Doesn't know or no response)	94	5.4%

Citing our previous definition of retrofit, we calculated the structural retrofit rates of homeowners.

Home has been at least partially retrofitted in some way (before or since purchase)	1054	60.1%
Has not been partially retrofitted in some way or doesn't know	701	39.9%

(Responses continued on next page)

TABLE A6 – Responses to Questions (continued)

Home has had a reasonably complete retrofit before or since purchase	588	33.5%
Has not had a reasonably complete retrofit or doesn't know	1167	66.5%
Has personally acted in some way to at least partially retrofit home	665	37.9%
Has not personally acted to retrofit home or doesn't know	1090	62.1%
Home was partially retrofitted in some way before purchased by owner	498	28.4%
Home was not partially retrofitted before purchased by owner or doesn't know	1257	71.6%

The number of those who acted to at least partially retrofit added to the number of respondents whose homes were partially retrofitted before they were purchased, is slightly higher than the *total* number of respondents with retrofitted homes. This is because some owners both bought an already retrofitted home *and* acted to further strengthen it.

7. For those responses *in Question 6* where no structural work has occurred, why have you decided **not** to do that work on ***this*** home? (Check all that apply)

1284 people gave at least one of these responses. Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to one of these questions, and not out of the total number of respondents.

I don't know anyone else who has done it.	275	21.4%
I don't know what I need to do.	550	42.8%
I think it's too <i>hard</i> to do.	117	9.1%
I think it <i>costs too much</i> for me to do.	485	37.8%
I don't think earthquakes are much of a problem in this home's neighborhood.	157	12.2%
I do not have the ability to get or repay the loan required to pay for the work.	174	13.6%
I think it's a bad investment.	60	4.7%
I haven't gotten around to it.	346	26.9%
I was afraid or intimidated by the City or County such as the building or planning department.	118	9.2%
I'm afraid my property taxes will go up if I do it.	83	6.5%
I know I'm not going to own my home for very long.	90	7.0%
I have earthquake insurance instead.	124	9.7%
Other	261	20.3%

(Responses continued on next page)

TABLE A6 – Responses to Questions (continued)

Most common responses in “other” category:

- Hadn’t heard of these structural measures (especially plywood in crawl space and garage door strengthening).
- Doesn’t think structural measures are needed/house has held up all these years.
- No crawl space/garage.

8. If any earthquake strengthening was done before you purchased the home, was it a factor in your decision to purchase this home?

Yes, a lot	66	4.2%
Somewhat	150	9.5%
Not much	135	8.5%
Not at all	423	26.7%
Not applicable	812	51.2%

9. Date(s) work was done: (Fill in year. If you’ve done more than one strengthening project, list years.)

<1980	29	5.2%
1980-1989	90	16.3%
1990+	434	78.5%

Since some homeowners listed many years, only the *last* year that work was done was included in the calculations.

10. Who did the retrofit work?

I did all the work myself.	99	16.8%
I hired a contractor to do the work.	397	67.2%
I did some of the work myself, but also hired a contractor.	95	16.1%

11. How did you pay for the work?

568 people gave at least one of these responses. Percentages do not equal 100% because many respondents checked more than one answer. The percentages are only out of the universe of those responding to one of these questions, and not out of the total number of respondents.

Loan or refinance	151	26.6%
Cash or credit card	430	75.7%
Support from a government program	16	2.8%

TABLE A6 – Responses to Questions (continued)

12. Did you hire or talk with a civil/structural engineer or architect prior to retrofitting this home?

Yes	290	48.2%
No	312	51.8%

13. Approximately how much money did you spend on the retrofit work?
(The question was open-ended. We sorted the data into categories.)

Under \$500	38	9.1%
\$500-\$999	33	7.9%
\$1,000-\$1,999	57	13.7%
\$2,000-\$2,999	46	11.0%
\$3,000-\$3,999	39	9.4%
\$4,000-\$4,999	17	4.1%
\$5,000-\$5,999	31	7.4%
\$6,000-\$9,999	18	4.3%
\$10,000-\$14,999	35	8.4%
\$15,000-\$19,999	14	3.4%
\$20,000-\$24,999	14	3.4%
\$25,000-\$29,999	8	1.9%
\$30,000-\$34,999	11	2.6%
\$35,000-\$39,000	5	1.2%
\$40,000+	51	12.2%

Average Amount Spent	\$17,896
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Many respondents included the cost of the entire remodel of their home.

*14. Why did you decide to do the **structural** work?*

578 people gave at least one of these responses. Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to one of these questions, and not out of the total number of respondents.

I knew someone else, such as a friend, who had also strengthened their home.	67	11.6%
I am concerned about damaging earthquakes in this home's neighborhood.	315	54.5%
I found out about a problem when I bought the home.	45	7.8%
I got a letter or call from a contractor offering to do the work.	16	2.8%
I thought it was a good investment, or a good selling point.	157	27.2%
The City or County (such as building or planning staff) helped me.	27	4.7%

(Responses continued on next page)

TABLE A6 – Responses to Questions (continued)

I knew my property taxes would NOT go up if I did this.	40	6.9%
I thought that I could retrofit my home and not need earthquake insurance.	52	9.0%
I did the work because the home was damaged in an earthquake.	38	6.6%
I found out I would get a discount on my earthquake insurance.	28	4.8%
I was concerned after I saw damage to homes in an earthquake.	149	25.8%
I became concerned after earthquake scientists talked about Bay Area earthquakes.	153	26.5%
I wanted to feel safer.	323	55.9%
Other	160	27.7%

Of the 27 respondents who responded that they decided to do structural work because the City or County helped them, 10 lived in Berkeley, 6 in San Leandro, and another 3 in Palo Alto. Berkeley respondents stated that they received help from the City in receiving a home sales tax rebate and in organizing City neighborhood talks about earthquake preparedness. The San Leandro respondents gushed about the resources and help offered by the City – in offering a retrofit class, allowing them to borrow tools, helping with sample plans, and offering permit process support as well as a free consultation. The Palo Alto respondents stated that their structural work was required by city permit.

Most common responses in “other” category:

- Structural work done as part of larger remodel of home or in conjunction with other repairs.
- Work required by earthquake insurance company.

Part II

A. Where did you live in 1989 when the Loma Prieta earthquake happened?

In this home	1013	58.6%
Not in this home, but in California	624	36.1%
Outside of California	92	5.3%

B. Have you ever experienced a major damaging earthquake?

Yes	918	53.7%
No	791	46.3%

Although many respondents experienced the 1989 Loma Prieta earthquake, many didn’t believe that this earthquake counted because they didn’t have any major damage to their personal property.

TABLE A6 – Responses to Questions (continued)

C. What do you believe is the risk a major earthquake will affect this home's neighborhood?

Very High	278	16.7%
Moderately High	653	39.1%
Moderately Low	566	33.9%
Very Low	172	10.3%

*D. Do you know someone (such as a friend or neighbor) who has done additional **structural** work on their home to provide for additional safety in an earthquake?*

Yes	589	34.9%
No	1097	65.1%

E. Have you seen ABAG's earthquake shaking hazard maps for your city?

Yes	314	18.4%
No	1397	81.6%

F. Do you live in this home?

Yes	1498	87.1%
No, I rent it out	210	12.2%
No, it is vacant	12	0.7%

*G. Do you have earthquake insurance for **this** home?*

Yes	499	29.2%
No, but I used to.	386	22.6%
No, I have never purchased earthquake insurance for this home.	823	48.2%

(The following is a follow-up question for those responding to *No, but I used to.*)

I stopped paying for insurance in _____ (year).

(The question was open-ended. We sorted the data into categories.)

< 1994	40	12.0%
1994	15	4.5%
1995	24	7.2%
1996	74	22.2%
1997	138	41.3%
1998	43	12.9%

TABLE A6 – Responses to Questions (continued)

*H. Do you have food and water at **your** home to help you survive after an earthquake?*

Yes, for more than 4 days	498	29.3%
Yes, for 3-4 days	518	30.5%
Yes, for 1-2 days	396	23.3%
No	287	16.9%

I. How much school have you completed. Check highest degree received.

I attended school, but did not complete High School (12 th grade).	86	5.1%
I graduated from High School (or equivalent, such as GED).	472	28.0%
I graduated from college (Bachelor's degree or higher).	1126	66.9%

J. How old are you?

Younger than 35	125	7.8%
35 to 64 years old	1006	62.5%
65 or older	479	29.8%

K. What is your approximate family income?

Less than \$20,000 / year	153	10.6%
\$20,000 to \$39,000 / year	254	17.5%
\$40,000 to \$59,000 / year	306	21.1%
\$60,000 to \$79,000 / year	229	15.8%
\$80,000 to \$99,000 / year	160	11.0%
More than \$100,000 / year	347	23.9%

L. May we contact you if we have any questions?

Yes	892	55.5%
No	715	44.5%

Comments

On the final page we requested comments – in particular comments respondents might have about their answers, and ideas on what Cities and Counties could do to encourage them to strengthen their homes. 628 respondents included comments. The following were the most common subjects discussed in the comments field:

(Responses continued on next page)

TABLE A6 – Responses to Questions (continued)

Insurance (too costly, state “messed it up”)	73	11.6%
Contractors (should be a list of reliable/approved contractors; don’t trust contractors)	32	5.1%
Loans (government should offer low interest loans)	30	4.8%
Taxes (government should offer tax breaks/incentives to retrofit; property taxes shouldn’t be increased for retrofit work done)	25	4.0%

OPEN-ENDED COMMENTS

Some interesting information was collected through the open-ended comments area of the survey. One recurring element was that many of the respondents were quite old and often proud of this, writing down their exact age (though we did not ask for it specifically), which was often in the nineties. Although homeowners are often older because of the money needed to earn over time to purchase a home, these homeowners reflected an even older segment of the population than expected. This is likely because our survey targeted houses that were built before 1960, and many of these homeowners had lived in their homes for several decades. Also, being retired, they might have had more time to fill out our survey.

Dissatisfaction with earthquake insurance was mentioned in dozens of surveys. Many people were aggravated by the high cost and the low deductible in insurance since it was taken over by the state. With many homeowners discontinuing insurance in the last two years, it was apparent that the state takeover of earthquake insurance was the primary motivation.

Problems with contractors were cited quite often as reasons for not retrofitting. Homeowners didn’t trust contractors because they believed contractors either might do the retrofit work incorrectly or charge too much for unneeded work.

OVERALL RETROFIT RESULTS

ACTED TO AT LEAST PARTIALLY RETROFIT RESULTS

Again, it is useful to keep in mind that these overall results do not represent the whole Bay Area since survey were sent to seventeen selected jurisdictions. Additionally, these results are skewed because homeowners that retrofitted were more likely to respond to the survey.

We analyzed the responses of homeowners that had acted to at least partially structurally retrofit their homes in order to determine relationships between variables. The following variables appeared to bear some correlation to whether or not the homeowner acted to at least partially retrofit (refer to TABLE A7 – *Acted to at Least Partially Retrofit Home: Possible Influential Variables*).

**TABLE A7 — Acted to at Least Partially Retrofit Home
Possible Influential Variables**

<i>Variable</i>	<i>Acted to at Least Partially Retrofit Home</i>		<i>Has Not Acted to at Least Partially Retrofit Home</i>		<i>Total</i>
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	
Home built <1900	18	40.9%	26	59.1%	44
Home built 1900-1909	44	53.7%	38	46.3%	82
Home built 1910-1919	61	53.0%	54	47.0%	115
Home built 1920-1929	183	55.0%	150	45.0%	333
Home built 1930-1939	100	43.7%	129	56.3%	229
Home built 1940-1949	122	31.9%	260	68.1%	382
Home built 1950+	116	23.5%	378	76.5%	494
Home renovated	325	50.3%	321	49.7%	646
Home not renovated	323	30.4%	741	69.6%	1064
Non-struct. measures	593	41.3%	842	58.7%	1435
No non-struct. measures	72	22.5%	248	77.5%	320
Lived in home in 1989	458	45.2%	555	54.8%	1013
Lived in Calif in 1989	168	26.9%	456	73.1%	624
Lived outside Calif in '89	28	30.4%	64	69.6%	92
Experienced quake	395	43.0%	523	57.0%	918
Never experienced quake	252	31.9%	539	68.1%	791
Very high EQ risk	145	52.2%	133	47.8%	278
Moderately high EQ risk	267	40.9%	386	59.1%	653
Moderately low EQ risk	179	31.6%	387	68.4%	566
Very low EQ risk	43	25.0%	129	75.0%	172
Friend has acted	326	55.3%	263	44.7%	589
No friend acted	308	28.1%	789	71.9%	1097
Saw ABAG maps	155	49.4%	159	50.6%	314
Didn't see ABAG maps	491	35.1%	906	64.9%	1397
Live in home	606	40.5%	892	59.5%	1498
Rent out home	47	22.4%	163	77.6%	210
Home is vacant	1	8.3%	11	91.7%	12
Have EQ insurance	236	47.3%	263	52.7%	499
Did have EQ insurance	151	39.1%	235	60.9%	386
Never had EQ insurance	261	31.7%	562	68.3%	823
Food-water for >4 days	210	47.9%	228	52.1%	438
Food-water for 3-4 days	210	40.5%	308	59.5%	518
Food-water for 1-2 days	148	37.4%	248	62.6%	396
No food-water	77	26.8%	210	73.2%	287
No high school	26	30.2%	60	69.8%	86
Graduated high school	143	30.3%	329	69.7%	472
Graduated college	469	41.7%	657	58.3%	1126
Age of owner <35	25	20.0%	100	80.0%	125
Age of owner 35-64	378	37.6%	628	62.4%	1006
Age of owner 65+	193	40.3%	286	59.7%	479

(Responses continued on next page)

**TABLE A7 — Acted to at Least Partially Retrofit Home
Possible Influential Variables (continued)**

<i>Variable</i>	<i>Acted to at Least Partially Retrofit Home</i>		<i>Has Not Acted to at Least Partially Retrofit Home</i>		<i>Total</i>
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	
Income <\$20K	42	27.5%	111	72.5%	153
Income \$20-40K	78	30.7%	176	69.3%	254
Income \$40-60K	114	37.3%	192	62.7%	306
Income \$60-80K	74	32.3%	155	67.7%	229
Income \$80-100K	68	42.5%	92	57.5%	160
Income >\$100K	154	44.4%	193	55.6%	347
First survey	347	41.1%	498	58.9%	845
Postcard	120	35.9%	214	64.1%	334
Second survey	198	34.4%	378	65.6%	576

Influencing Variables

Decade Home Built

With the exception of homes built before 1900,¹ the homeowner had most often acted to at least partially retrofit in homes built before 1930 – decreasing slightly each decade since. Our previously stated definition of retrofit stated that homes built in 1950 and afterwards had to have plywood installed to be deemed a retrofit, while homes built before 1950 only needed to have either been bolted to the foundation or have had plywood installed. Therefore, it seems that it may have been easier for homes built before 1950 to have been deemed retrofitted in the course of this survey.

Renovation

Homes that had been substantially changed with a major renovation were 19.9% more likely to have been retrofitted by the current homeowner. This relationship makes sense since many homeowners complete structural work while executing a major renovation.

Nonstructural Measures

Homeowners that took nonstructural measures to safeguard their home were 18.8% more likely to have acted to at least partially retrofit their homes.

Where Lived in 1989

Respondents who lived in their current homes in 1989 were 14.8-18.3% more likely to have completed structural work on their homes than respondents who did not live there in 1989.

Experiencing an Earthquake

Homeowners who had experienced a major earthquake were 11.1% more likely to have retrofitted their homes, than those that hadn't experienced a major quake.

¹ In homes built before 1900, responses are insufficient to reduce sampling error to less than 10%.

Risk Perception

Owners were most likely to have acted to at least partially retrofit when their risk perception of a major earthquake occurring in their neighborhood was in the “very high” category, decreasing slightly with the perception of lessened risk. Those that perceived a “very high” risk were 27.2% more likely to retrofit than those perceiving a “very low” risk.

Knows Someone Who Has Acted

Having a friend that had retrofitted meant that the respondent was 27.2% more likely to have also acted to at least partially retrofit.

ABAG Maps

Respondents who had seen ABAG’s earthquake shaking hazard maps were 14.3% more likely to have retrofitted.

Respondents that had seen these maps in general had higher perceptions of earthquake risk than those who had not. 71.2% of residents with very to moderately high perceptions of earthquake risk had also seen the ABAG maps, while only 52.4% of residents with very to moderately low perceptions of earthquake risk had done the same. Although it is difficult to determine a causal relationship between the variables, it is likely that seeing the ABAG maps would increase a homeowner’s earthquake risk perception (refer to TABLE A8 – *ABAG Earthquake Shaking Hazard Maps and Risk Perception*).

TABLE A8 – ABAG Earthquake Shaking Hazard Maps and Risk Perception

<i>Risk Perception</i>	<i>Saw ABAG Maps</i>		<i>Hasn't Seen ABAG Maps</i>	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Very high earthquake risk	94	30.4%	180	13.4%
Moderately high earthquake risk	126	40.8%	524	39.0%
Moderately low earthquake risk	76	24.6%	485	36.1%
Very low earthquake risk	13	4.2%	153	11.4%

Owners and Renters

Living in the home, as opposed to renting it out, was connected to whether or not the homeowner retrofitted, with owner-occupants being 18.1% more likely to have acted to at least partially retrofit than owners who rent the home.

Earthquake Insurance

Respondents that currently purchase earthquake insurance were 8.2% more likely to have acted to at least partially retrofit than those that used to have the insurance, and 15.6% more likely than those that have never had it.

Food and Water

Having adequate food and water appeared to be directly correlated with whether or not the homeowner had acted to at least partially retrofit, increasing as more food and water

were on hand. This earthquake preparedness action showed that respondents with over four days of food and water were 21.1% more likely to have acted to at least partially retrofit than those with none of these supplies.

Educational Attainment

Respondents that had only graduated high school seemed to not be all that different than those that hadn't graduated from high school in terms of their propensity to retrofit. In contrast, respondents that had graduated from college were at least 11.4% more likely than either of these groups to have retrofitted.

It appears as though there is a relationship between high educational attainment and high levels of earthquake risk perception. Among respondents that had graduated from college, 62.4% had very to moderately high perceptions of earthquake risk. This percentage fell to 45.1% among high school graduates and 34.6% among those not completing high school (refer to TABLE A9 – *ABAG Earthquake Shaking Hazard Maps and Risk Perception*).

TABLE A9 – Educational Attainment and Risk Perception

<i>Risk Perception</i>	<i>Educational Attainment</i>					
	<i>Didn't finish high school</i>		<i>Graduated high school</i>		<i>Graduated college</i>	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Very high EQ risk	7	9.3%	50	11.0%	218	19.9%
Mod. high EQ risk	19	25.3%	155	34.1%	466	42.5%
Mod. low EQ risk	27	36.0%	181	39.9%	340	31.0%
Very low EQ risk	22	29.3%	68	15.0%	72	6.6%

However, respondents that didn't graduate from high school had the highest proportion that responded that they also had food and water on hand for four or more days with 35.7%. Among respondents that had graduated from high school, but had not graduated from college, 30.5% had a supply of food and water for four or more days, while only 28.1% of those that had graduated from college were so prepared (refer to TABLE A10 – *Effect of Educational Attainment on Food and Water Earthquake Preparedness*).

TABLE A10 – Effect of Educational Attainment on Food and Water Earthquake Preparedness

<i>Food-Water EQ Preparedness</i>	<i>Educational Attainment</i>					
	<i>Didn't Graduate High School</i>		<i>Graduated High School</i>		<i>Graduated College</i>	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Food-Water 4+ Days	30	35.7%	141	30.5%	313	28.1%
Food-Water 3-4 Days	22	26.2%	133	28.7%	352	31.6%
Food-Water 1-2 Days	15	17.9%	109	23.5%	263	23.6%
No Food-Water	17	20.2%	80	17.3%	185	16.6%

Age of Owner

Although there did not seem to be a considerable difference in the rates of those acting to at least partially retrofit that were 35-64 years old and those 65 and older, homeowners younger than 35 were at least 17.6% less likely to have done this work.

Household Income

With one exception, the rate of those acting to at least partially retrofit rose with each increasing level of household income. Those earning over \$100,000 a year were 16.9% more likely to have acted to at least partially retrofit than those making less than \$20,000 a year.

We believed that “it costs too much” as a reason for the homeowner to have not retrofitted might be a catchall excuse for a majority of homeowners that hadn’t gotten around to doing the work. In order to find to what extent “it costs too much” really *did* indicate that the homeowner could not afford to do the retrofit work, we analyzed income and the “it costs too much” reason for not retrofitting (refer to TABLE A11 – *Effect of Income on Perceived Cost of Retrofit*). Thus, we looked at the percentage of respondents in each income category that had not executed a retrofit because of cost. In addition, we found the difference between this percentage and the percentage of homeowners that gave at least one reason for not retrofitting. Overall, the greatest absolute difference was in the lowest and highest income categories. This indicates that cost is more important among respondents earning less than \$20,000 per year and less important among respondents earning more than \$100,000 per year.

TABLE A11 – Effect of Income on Perceived Cost of Retrofit

<i>Income per Year</i>	<i>Gave at least one reason for not retrofitting</i>		<i>Didn't do retrofit work because of cost</i>		<i>Difference</i>
	#	%	#	%	
Less Than \$20,000	111	12.1%	77	17.7%	5.6%
\$20,000-\$39,000	176	19.2%	94	21.6%	2.4%
\$40,000-\$59,000	192	20.9%	97	22.2%	1.4%
\$60,000-\$79,000	155	16.9%	76	17.4%	0.6%
\$80,000-\$99,000	92	10.0%	44	10.1%	0.1%
Over \$100,000	193	21.0%	48	11.0%	-10.0%
Total	919		436		

RESULTS OF PARTIAL AND REASONABLY COMPLETE RETROFITS

Correlations between variables and homes with partial and reasonably complete or full retrofits followed the same pattern as above for respondents that acted to at least partially retrofit. Only those cases which did not follow this pattern will be detailed below (refer to TABLE A12 – *Partial and Reasonably Complete Retrofits: Possible Influential Variables*). With one exception, the rate of reasonably complete retrofits is consistently lower than that of homes that are at least partially retrofitted.

**TABLE A12 — Partial and Reasonably Complete Retrofits ¹
Possible Influential Variables**

<i>Variable</i>	<i>Partial Retrofit of Home</i>		<i>Reasonably Complete Retrofit of Home</i>		<i>Total</i>
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	
Home built <1900	35	83.3%	24	57.1%	42
Home built 1900-1909	63	76.8%	44	53.7%	82
Home built 1910-1919	87	75.7%	55	47.8%	115
Home built 1920-1929	255	76.6%	145	43.5%	333
Home built 1930-1939	171	74.7%	86	37.6%	229
Home built 1940-1949	253	66.2%	91	23.8%	382
Home built 1950+	153	31.0%	113	22.9%	494
Home renovated	479	74.1%	291	45.0%	646
Home not renovated	552	51.9%	286	26.9%	1064
Non-struct. measures	923	64.3%	532	37.1%	1435
No non-struct. measures	131	40.9%	56	17.5%	320
Lived in home in 1989	620	61.2%	354	34.9%	1013
Lived in Calif in 1989	355	56.9%	192	30.8%	624
Lived outside Calif in '89	63	68.5%	35	38.0%	92
Experienced quake	599	65.3%	349	38.0%	918
Never experienced quake	424	53.6%	225	28.4%	791
Very high EQ risk	198	71.2%	120	43.2%	278
Moderately high EQ risk	421	64.5%	233	35.7%	653
Moderately low EQ risk	302	53.4%	175	30.9%	566
Very low EQ risk	84	48.8%	38	22.1%	172
Friend has acted	440	74.7%	289	49.1%	589
No friend acted	571	52.1%	283	25.8%	1097
Saw ABAG maps	224	71.3%	153	48.7%	314
Didn't see ABAG maps	803	57.5%	422	30.2%	1397
Live in home	944	63.0%	535	35.7%	1498
Rent out home	86	41.0%	45	21.4%	210
Home is vacant	4	33.3%	0	0.0%	12
Have EQ insurance	343	68.7%	203	40.7%	499
Did have EQ insurance	237	61.4%	147	38.1%	386
Never had EQ insurance	446	54.2%	224	27.2%	823
Food-water for >4 days	304	61.0%	171	34.3%	498
Food-water for 3-4 days	331	63.9%	182	35.1%	518
Food-water for 1-2 days	244	61.6%	139	35.1%	396
No food-water	143	49.8%	83	28.9%	287
No high school	45	52.3%	20	23.3%	86
Graduated high school	228	48.3%	101	21.4%	472
Graduated college	744	66.1%	451	40.1%	1126
Age of owner <35	69	55.2%	31	24.8%	125
Age of owner 35-64	614	61.0%	355	35.3%	1006
Age of owner 65+	266	55.5%	145	30.3%	479

(Responses continued on next page)

**TABLE A12 — Partial and Reasonably Complete Retrofits
Possible Influential Variables (continued)**

<i>Variable</i>	<i>Partial Retrofit of Home</i>		<i>Reasonably Complete Retrofit of Home</i>		<i>Total</i>
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	
Income <\$20K	65	42.5%	18	11.8%	153
Income \$20-40K	137	53.9%	71	28.0%	254
Income \$40-60K	174	56.9%	89	29.1%	306
Income \$60-80K	134	58.5%	77	33.6%	229
Income \$80-100K	109	68.1%	65	40.6%	160
Income >\$100K	248	71.5%	163	47.0%	347
First survey	534	63.2%	311	36.8%	845
Postcard	199	59.6%	105	31.4%	334
Second survey	320	55.6%	172	29.9%	576

Note 1. Because of the differences in definition between partial and reasonably complete (or full) retrofits, it is possible that a home was deemed as having had a reasonably complete retrofit without being defined as at least partially retrofitted. This occurred in 42 cases. For the most part this discrepancy occurred when the home was built in or after 1950 and didn't have plywood in the crawlspace because of the lack of or inaccessibility of a crawlspace. In this case the home was determined to have had a reasonably complete retrofit although it was not deemed to be at least partially retrofitted.

Influencing Variables

Decade Home Built

Although 66.2% of homes built between 1940-1949 had been partially retrofitted, the rate fell by more than half to 31.0% among homes built after 1950. This steep decline can probably be attributed to our definition of retrofit among homes built after 1950 which stated that these homes had have plywood in addition to bolts installed.

Where Lived in 1989

Surprisingly in the category of where the respondent lived in 1989, the demographic with the highest rate of at least partial retrofits and reasonably complete retrofits was those living outside California in 1989. This is a change from the statistics of those that acted to at least partially retrofit their homes. Additionally, the rates for partial and reasonably complete retrofits didn't change nearly as dramatically among variables in this category, as opposed to rates for respondents acting to at least partially retrofit their homes.

Food and Water

There didn't appear to be a significant difference between homeowners with 1-2 days or over 4 days of food and water with regards to having a home that has had a partial or reasonably complete retrofit. However, the likelihood that the respondent lived in a home with a partial or reasonably complete retrofit dropped significantly for those with no food or water earthquake preparedness.

Age of Owner

Although owners age 65 and over were more likely than younger respondents to have acted to at least partially retrofit their homes, this is not the case among homes that have been at least partially or fully retrofitted. In these homes the highest retrofit rate belonged to respondents 35-64 years of age. Additionally, the rates for partial retrofit is almost identical among respondents under 35 years and respondents 65 and over. This was not the case among respondents that had acted to at least partially retrofit, where respondents younger than 35 were 20.3% less likely to retrofit than respondents that were 65 and older.

Household Income

Rates of partial and reasonably complete retrofit rose steadily with each increasing level of household income. Although respondents that acted to at least partially retrofit had this same correlation, it was not as strong a correlation as found here. Respondents with incomes over \$100,000 per year were respectively 29.0% and 35.2% more likely to at least partially retrofit and give their homes a reasonably complete retrofit than those earning less than \$20,000 per year.

STATISTICAL TESTS

Chi square tests showed that the above variables were all correlated to whether or not the homeowner had acted to at least partially retrofit their homes. Additionally, logistic regression tests also showed that these variables were significant, and individually could be used to correctly predict whether or not the homeowner had acted to at least partially retrofit the home 61.63%-66.12% of the time (refer to TABLE A13 – *Acted to at Least Partially Retrofit Home: Statistical Analysis of Possible Influential Variables*). The variables were all within this tight range, most likely because – as chi square tests showed – these variables were correlated amongst themselves. Income level and whether a friend had acted were the two variables that best predicted whether or not the homeowner had retrofitted. All of the variables together could correctly predict if the respondent had acted to at least partially strengthen the home in 72.27% of cases.

Chi square tests and logistic regressions were also run with other variables. Both tests found a significant correlation between risk perception and educational attainment, which seems intuitive because people that are better informed about earthquake risk through newspapers and television are usually better educated.

TABLE A13 – Acted to at Least Partially Retrofit Home ^{1,2,3}
Statistical Analysis of Possible Influential Variables

Variable	Chi Square Test Significance Level	Logistic Regression		Conclusion Significant/ Not Significant
		Overall Ability to Predict Acted/ Not Acted	Significance Level	
Decade Home Built	0.0000	61.62%	0.0000	Significant
Home Renovated	0.0000	62.34%	0.0000	Significant
Nonstructural Measures	0.0000	62.11%	0.0000	Significant
Where Lived in 1989	0.0000	62.17%	0.0000	Significant
Experienced Major EQ	0.0000	62.14%	0.0000	Significant
Risk Perception	0.0000	62.01%	0.0000	Significant
Friend Has Acted	0.0000	66.13%	0.0000	Significant
Saw ABAG Maps	0.0000	62.24%	0.0000	Significant
Lives/Rents Home	0.0000	61.98%	0.0000	Significant
Has EQ Insurance	0.0000	62.06%	0.0000	Significant
Has Food and Water	0.0004	62.04%	0.0005	Significant
Educational Attainment	0.0000	62.11%	0.0000	Significant
Age of Owner	0.0008	62.98%	0.0009	Significant
Income	0.0000	63.42%	0.0000	Significant
<i>Friend and Income</i>	<i>0.0000</i>	<i>67.21%</i>	<i>-</i>	<i>Significant</i>
All Variables Together	0.0000	72.27%	-	Significant

Note 1. A significance level of less than .05 indicates that there is a relationship between the variable and whether or not the homeowner acted to at least partially retrofit.

Note 2. An ability to correctly predict whether or not the owner had acted at least partially retrofit 50% of the time would indicate that the variable has little or no correlation.

Note 3. Shaded percentages indicate variables with the highest overall ability to predict action by homeowners.

Also as expected, both the chi square test and the logistic regression found a significant relationship between the respondents' income and whether they didn't act to at least partially retrofit because the work cost too much. Additionally, both tests found no relationship between educational attainment and whether owners didn't act to at least partially retrofit because they were unsure what to do. This makes some sense because knowing how to retrofit is a "life skill" which is not taught in school. On the other hand, perceiving the risk in not retrofitting would be more likely to be related to school learning, causing those with higher educational attainment to find out how to get the retrofit work done (refer to TABLE A14 – *Predicting Variables by Knowing Educational Attainment or Income: Statistical Analysis*).

**TABLE A14 – Predicting Variables by Knowing
Educational Attainment or Income^{1,2}
Statistical Analysis**

Variables		Chi Square Test	Logistic Regression		Conclusion
<i>Variable That Can Be Predicted</i>	<i>Variable That Can Predict</i>	<i>Significance Level</i>	<i>Overall Ability to Predict Variable</i>	<i>Significance Level</i>	<i>Significant/ Not Significant</i>
Risk Perception	Educ. Attain.	0.0000	60.43%	0.0000	Significant
<i>Reason didn't do work:</i>					
Costs too much	Income	0.0000	60.61%	0.0000	Significant
Unsure what to do	Educ. Attain.	0.7987	-	0.7987	Not Significant

Note 1. A significance level of less than .05 indicates that there is a relationship between the variable and whether or not the homeowner acted to at least partially retrofit.

Note 2. An ability to correctly predict whether or not the owner had acted to at least partially retrofit 50% of the time would indicate that the variable has little or no correlation.

RESULTS OF CITIES VERSUS UNINCORPORATED AREAS

We wanted to compare cities and unincorporated areas because we believed that the number of owners acting to at least partially retrofit in unincorporated areas would be likely to be lower than that of cities. This was hypothesized because it is more difficult and intimidating to complete the retrofit process through the county government. Again, although the response rate for each city was high enough to make the results statistically valid, the response rate for each unincorporated area was not. Consequently, in order to obtain statistically valid results, we grouped the jurisdictions of Ashland-San Lorenzo, Crockett, and Lexington Hills together into “Unincorporated Areas.”

STRUCTURAL AND NONSTRUCTURAL MEASURES

The respondents in the combined unincorporated areas of Ashland-San Lorenzo, Crockett, and Lexington Hills all were less likely to have had retrofit work done than those responding from the cities in the survey. Consequently, 48.1% of respondents’ homes in unincorporated areas had been at least partially retrofitted, as compared to 60.8% for city respondents. Overall, only 26.9% of homes of respondents in unincorporated areas were found to have reasonably complete retrofits, compared to 33.9% of respondents’ homes in cities – exactly *double* the unincorporated rate. Additionally, compared to cities in which 38.5% of respondents had acted to at least partially retrofit, respondents in unincorporated areas were 10.6% less likely to have acted to retrofit. Respondents in cities, at 28.8%, were more likely to live in a home that had been retrofitted by previous residents, compared to 22.1% of respondents in unincorporated areas. Moreover, 82.6% of respondents living in cities, and 68.3% of respondents in unincorporated areas, lived in homes in which nonstructural measures had been taken, making homes in cities 14.3% more likely to have these measures (refer to TABLE A15 – *Comparison of Variables in Cities and Unincorporated Areas*).

TABLE A15 — Comparison of Variables in Cities and Unincorporated Areas ^{1,2}

Variable	Cities		Unincorporated Areas	
	Number	Percent	Number	Percent
Home at least partially retrofitted	1004	60.8%	50	48.1%
Home fully retrofitted	560	33.9%	28	26.9%
Owner acted to retrofit	636	38.5%	29	27.9%
Retrofitted before purchase	475	28.8%	23	22.1%
Nonstructural measures taken	1364	82.6%	71	68.3%
Home built <1900	42	2.7%	0	0.0%
Home built 1900-1909	81	5.1%	5	5.2%
Home built 1910-1919	110	7.0%	1	1.0%
Home built 1920-1929	314	19.9%	19	19.6%
Home built 1930-1939	216	13.7%	13	13.4%
Home built 1940-1949	343	21.7%	39	40.2%
Home built 1950+	474	30.0%	20	20.6%
Home renovated	607	37.7%	40	40.4%
Home not renovated	1004	62.3%	59	59.6%
Lived in home in 1989	949	58.4%	64	61.5%
Lived in Calif in 1989	589	36.2%	35	33.7%
Lived outside Calif in '89	87	5.4%	5	4.8%
Experienced quake	863	53.8%	55	52.9%
Never experienced quake	742	46.2%	49	47.1%
Very high EQ risk	263	16.7%	15	15.3%
Moderately high EQ risk	610	38.8%	43	43.9%
Moderately low EQ risk	533	33.9%	33	33.7%
Very low EQ risk	165	10.5%	7	7.1%
Friend has acted	562	35.4%	27	27.0%
No friend acted	1024	64.6%	73	73.0%
Saw ABAG maps	301	18.7%	13	13.0%
Didn't see ABAG maps	1310	81.3%	87	87.0%
Live in home	1408	86.9%	90	90.9%
Rent out home	202	12.5%	8	8.1%
Home is vacant	11	6.8%	1	1.0%
Have EQ insurance	470	29.3%	29	28.4%
Did have EQ insurance	359	22.4%	27	26.5%
Never had EQ insurance	777	48.4%	46	45.1%
Food-water for >4 days	462	28.9%	36	36.4%
Food-water for 3-4 days	489	30.6%	29	29.3%
Food-water for 1-2 days	381	23.8%	15	15.2%
No food-water	268	16.8%	19	19.2%
No high school	79	5.0%	7	7.1%
Graduated high school	423	26.7%	49	49.5%
Graduated college	1083	68.3%	43	43.4%
Age of owner <35	113	7.5%	12	11.8%
Age of owner 35-64	944	62.6%	62	60.8%
Age of owner 65+	451	29.9%	28	27.5%

(Responses continued on next page)

**TABLE A15 — Comparison of Variables in Cities and Unincorporated Areas
(continued)**

Variable	Cities		Unincorporated Areas	
	Number	Percent	Number	Percent
Income <\$20K	141	10.4%	12	13.6%
Income \$20-40K	231	17.0%	23	26.1%
Income \$40-60K	287	21.1%	19	21.6%
Income \$60-80K	213	15.7%	16	18.2%
Income \$80-100K	148	10.9%	12	13.6%
Income >\$100K	341	25.1%	6	6.8%

Note 1. For the first five retrofit categories at the top of the chart it was assumed that no answer to that question by the respondent meant no retrofit had taken place.

Note 2. “Owner acted to retrofit” refers to the owner acting to *at least partially* retrofit.

Note 3. Unincorporated areas include Ashland-San Lorenzo, Crockett, and Lexington Hills.

Statistical Tests

Additionally, chi square tests and logistic regressions showed that a relationship exists between whether or not the home is in a city or unincorporated area and the following variables: whether the home is at least partially retrofitted, whether the owner acted to at least partially retrofit, and whether nonstructural measures had been taken (refer to TABLE A16 – *Predicting Retrofit by Knowing City or Unincorporated Area: Statistical Analysis*). Logistic regressions showed that knowing solely whether the home was in a city or in an unincorporated area could be used to correctly predict whether the home had been at least partially retrofitted or whether the homeowner had acted to at least partially retrofit 60.28% and 62.11% of the time, respectively. Knowing this information could also correctly predict whether nonstructural measures had been taken in the home 81.71% of the time.

**TABLE A16 – Predicting Retrofit by Knowing City or Unincorporated Area^{1,2}
Statistical Analysis**

Variable <i>Variable That Can Be Predicted</i>	Chi Square Test	Logistic Regression		Conclusion
	Significance Level	Overall Ability to Predict Variable	Significance Level	Significant/ Not Significant
Home Partially Retrofitted	0.0110	60.28%	0.0108	Significant
Home Fully Retrofitted	0.0786	-	0.0861	Not Significant
Owner Acted to Retrofit	0.0269	62.11%	0.0318	Significant
Retrofitted Before Purchase	0.1349	-	0.1461	Not Significant
Nonstructural Measures	0.0006	81.77%	0.0003	Significant

Note 1. “Home fully retrofitted” indicates that the home has a reasonably complete retrofit. “Owner acted to retrofit” indicates that the owner has acted to *at least partially* retrofit.

Note 2. A significance level of less than .05 indicates that there is a relationship between the variable and whether or not the homeowner acted to at least partially retrofit.

Note 3. An ability to correctly predict whether or not the owner had acted at least partially retrofit 50% of the time would indicate that the variable has little or no correlation.

However, chi square tests and logistic regressions showed *no* significant correlation between knowing whether or not the home was located in an incorporated area and two significant measures of retrofit: whether the home had a reasonably complete retrofit and whether retrofit work had been done before being purchased by the current owner.

INFLUENCING VARIABLES

In comparing the respondents' answers, there were a few notable differences in the demographics of the respondents in cities versus unincorporated areas, specifically with regards to educational attainment and income.

Of those living in unincorporated areas, 43.4% had graduated from college, while among city respondents this rate was 24.9% higher, with 68.3% possessing college degrees. The income distribution among respondents from cities was fairly bell-shaped, but increased again at the end of the distribution with the greatest number of respondents in the highest income category. However, among respondents in unincorporated areas, this curve was much more bell-shaped, with the largest number of respondents in the second to lowest income category. Moreover, the highest income category had the least respondents in unincorporated areas; those living in cities were 18.3% more likely to belong to this category.

Because educational attainment and income were previously shown to be correlated to whether or not the homeowner acted to at least partially retrofit, these demographics lowered the retrofit rate in unincorporated areas. Thus, owners being intimidated by the county government to begin the retrofit process is not as significant a factor as might otherwise be concluded.

RESULTS OF DIFFERENCES AMONG CITIES

STRUCTURAL MEASURES

By City

Overall, 60.0% of survey respondents lived in homes that had been at least partially retrofitted. Berkeley had the highest retrofit rate of all the cities with 82.8% of homes retrofitted. This City was followed closely by Los Gatos with 82.2%. In contrast, in Concord only 28.7% of the homes had been retrofitted – the lowest retrofit rate of all the cities. Santa Clara had the second lowest retrofit rate among respondents at 29.2% (refer to TABLE A17 – *Retrofit Rates by City*).

A reasonably complete or full retrofit had been executed in 33.5% of all homes. Berkeley and Oakland had the highest rate of this retrofit type at 62.8% and 51.4% respectively. On the other end of the spectrum, Santa Clara had the lowest rate of reasonably complete retrofit at 12.3%, followed by Napa with 12.8%.

TABLE A17 — Retrofit Rates by City^{1,2,3,4}

	Home at Least Partially Retrofitted		Home with Reasonably Complete Retrofit		Owner Acted to at Least Partially Retrofit		Home Retrofitted Before Purchase	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Alameda	93	78.8%	54	45.8%	61	51.7%	40	33.9%
Berkeley	149	82.8%	113	62.8%	117	65.0%	51	28.3%
Concord	31	28.7%	26	24.1%	20	18.5%	15	13.9%
Daly City	45	42.1%	25	23.4%	33	30.8%	19	17.8%
Los Gatos	37	82.2%	22	48.9%	25	55.6%	16	35.6%
Napa	31	39.7%	10	12.8%	16	20.5%	17	21.8%
Oakland	108	75.0%	74	51.4%	82	56.9%	38	26.4%
Palo Alto	101	62.3%	59	36.4%	60	37.0%	48	29.6%
Richmond	59	58.4%	18	17.8%	27	26.7%	42	41.6%
San Francisco	120	73.6%	82	50.3%	81	49.7%	50	30.7%
San Jose	87	57.2%	28	18.4%	50	32.9%	45	29.6%
San Leandro	57	52.8%	22	20.4%	33	30.6%	30	27.8%
Santa Clara	19	29.2%	8	12.3%	9	13.8%	13	20.0%
Santa Rosa	62	56.4%	17	15.5%	21	19.1%	47	42.7%
Other	5	50.0%	2	20.0%	1	10.0%	4	40.0%
<i>Unincorp. Areas</i>	50	48.1%	28	26.9%	29	27.9%	23	22.1%
<i>Cities</i>	1004	60.9%	560	33.9%	636	38.8%	475	28.9%
Total	1054	60.0%	588	33.5%	665	37.9%	498	28.4%

Note 1. The number of those who acted to at least partially retrofit added to the number of respondents whose homes were retrofitted before they were purchased, is slightly more than the *total* number of respondents with retrofitted homes because some owners both bought an already retrofitted home and acted to further strengthen it.

Note 2. Because of the differences in definition between partial and reasonably complete retrofits, it is possible that a home was defined as a reasonably complete retrofit but not partially retrofitted. This occurred in 42 cases. For the most part this discrepancy occurred when the home was built in or after 1950 and didn't have plywood in the crawlspace because of the lack of or inaccessibility of a crawlspace. In this case the home was determined to be a reasonably complete retrofit as well as not partially retrofitted.

Note 3. Light shading indicates the highest retrofit rates, while dark shading indicates the lowest retrofit rates.

Note 4. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills is included in "Unincorporated Areas."

The rate of reasonably complete retrofit of some cities, such as Richmond and Santa Rosa, dropped considerably from the partial retrofit rate – for these cities about 41.0%. This might indicate that although homeowners in these cities for the most part have at least partially retrofitted their homes, they haven't executed a reasonably complete retrofit. However, the reasonably complete retrofit rate in some cities was not all that different than the partial retrofit rate. Concord, for instance, had the smallest difference between these two rates, with a partial retrofit rates of 28.7% and only 4.6% less people with homes that had reasonably complete retrofits.

As mentioned previously our definitions for partial and reasonably complete retrofits differed, primarily with regards to installing plywood in the crawlspace. For a home built in 1950 or after, plywood must have been added to the crawlspace to be defined as partially retrofitted, regardless of whether or not the home had an accessible crawlspace. However, if the home didn't have plywood in place because of the lack or inaccessibility of a crawlspace, the home was defined as having had a reasonably complete retrofit. As a result for cities with a large proportion of homes built in or after 1950, the rate of reasonably complete retrofit would be higher.

Interestingly, San Leandro's reasonably complete retrofit rate of 50.9% dropped only slightly from its partial retrofit rates of 52.8% with a difference of 1.9%. Since there are a large proportion of homes built before 1950 in San Leandro, it is less likely that this is because of the discrepancy in retrofit definitions with regards to the crawlspace. It seems that a likely reason for the very small change in retrofit rates is that the respondents are doing the retrofit correctly and in its entirety. Berkeley, on the other hand, had a steeper drop of 8.4% between its reasonably complete retrofit rate of 82.8% and its partial retrofit rate of 74.4% which might indicate that respondents were not as likely to do a complete retrofit as those in San Leandro. However, compared to San Leandro, a greater percentage of homes in Berkeley were built before 1950.

Of homes that had been retrofitted, a total of 37.9% of respondents stated that they had acted to at least partially retrofit. Again Berkeley had the highest rate with 65.0% of respondents, followed by Oakland at 56.9%, Los Gatos at 55.6%, and Alameda at 51.7%. At 13.8%, Santa Clara this time had the lowest rate of homeowners acting to at least partially retrofit, followed by Concord at 18.5%, Santa Rosa at 19.1%, and Napa at 20.5%.

Overall, 28.4% of respondents' homes had been retrofitted before being purchased by the current owner.² Santa Rosa respondents had the highest rate with 42.7%, despite having previously displayed one of the lowest rates of respondents acting to at least partially retrofit. Richmond followed closely behind with 41.6% of respondents' homes. Conversely, Concord again was the lowest, with 13.9%, followed by Daly City with 17.8% of respondents having bought homes that had been previously retrofitted.

² The total number of those that have acted to retrofit *and* those that bought a home that was already retrofitted do *not* add up to the total number of retrofitted homes. This is because a number of respondents stated that they had worked to retrofit their homes both before *and* after they were purchased.

The current owner had acted to at least partially retrofit in the majority of homes that had been structurally strengthened. This was not the case, however, in Santa Rosa, Richmond, Santa Clara, and Napa, in which most of survey respondents bought homes that already had structural work completed.

San Leandro performed slightly below average with regard to each of these retrofit rates. In contrast, Berkeley had the highest rate of all the cities in the category of homes having been retrofitted, and in the category of current owners acting to at least partially retrofit. The City only performed close to the average in the final retrofit category – whether the home had been retrofitted before being purchased by the current owner. Palo Alto did not perform as highly as expected with regards to home retrofit. Although the City has a high educational attainment, its retrofit rates were only slightly above average.

Strengthening of Garage Door Opening

Additionally, we looked at the structural measure, strengthening of the garage door opening by city, because of the surprisingly high rate of full or reasonable complete retrofit. We chose this measure because it is the rarest form of structural retrofit. Because we were suspicious of the reasonably complete retrofit data we looked at strengthening of the garage door opening by city to see if any obvious patterns emerged (refer to TABLE A18 – *Strengthening of Garage Door Opening by City*).

We found that overall 23.7% of homes had structural work on the garage – most commonly by the current owner. San Francisco and San Jose had the highest rate of strengthening of the garage door opening by the previous or current owner with 33.1% and 28.2% respectively. At the other end of the spectrum, Santa Clara, with 9.3%, and Napa, with 16.3% had the lowest rates for this type of retrofit by the previous or current owner. Among the current owners, 24.0% of Berkeley respondents and 23.5% of San Jose respondents had done structural work on their garages – the highest rates of all the cities studied. Again, Santa Clara had an extremely low rate of this work with 1.9%, followed by 13.9% in Santa Rosa. With the exception of San Jose and Concord – two cities which had much lower rates of owners acting to at least partially retrofit – these cities' rates of strengthening the garage door opening overall followed the same patterns with regard to the previous retrofit variables.

Overall, the numbers of respondents whose garage door opening had been strengthened seemed very high, since this type of retrofit is known to be the rarest. We believed that this might be because of a skewing problem, that those with this garage work might be over-represented because they would be more likely to return the survey. We also postulated that these numbers might be high because the respondent didn't understand the question, or gave themselves credit for retrofitting when their work on the garage was not structural.

TABLE A18 - Strengthening of Garage Door Opening by City ^{1,2,3}

Jurisdiction	Garage Door Opening Has Been Strengthened							
	By Previous or Current Owner				By Current Owner			
	# Homes with strengthening by previous or current owner	# Homes with no garage/ detached	# Total respondents in city	% Homes with strengthening (not including homes with no garage/ detached)	# Homes with strengthening by current owner	# Homes with no garage/ detached	# Total respondents in city	% Homes with strengthening (not including homes with no garage/ detached)
Alameda	20	35	118	24.1%	16	35	118	19.3%
Berkeley	29	76	180	27.9%	25	76	180	24.0%
Concord	16	39	108	23.2%	15	39	108	21.7%
Daly City	26	3	107	25.0%	21	3	107	20.2%
Los Gatos	8	16	45	27.6%	6	16	45	20.7%
Napa	7	35	78	16.3%	7	35	78	16.3%
Oakland	19	41	144	18.4%	18	41	144	17.5%
Palo Alto	25	53	162	22.9%	20	53	162	18.3%
Richmond	20	22	101	25.3%	15	22	101	19.0%
San Francisco	48	18	163	33.1%	31	18	163	21.4%
San Jose	24	67	152	28.2%	20	67	152	23.5%
San Leandro	16	33	108	21.3%	11	33	108	14.7%
Santa Clara	5	11	65	9.3%	1	11	65	1.9%
Santa Rosa	14	37	110	19.2%	10	37	110	13.7%
Other	0	4	10	0.0%	0	4	10	0.0%
Unincorp. Areas	15	34	104	21.4%	11	34	104	15.7%
Cities	277	490	1,651	23.9%	216	490	1,651	18.6%
Total	292	524	1,755	23.7%	227	524	1,755	18.4%

Note 1. If the respondent did not answer this question, it was assumed that no strengthening of the garage door opening occurred.

Note 2. Light shading indicates the highest retrofit rates, while dark shading indicates the lowest retrofit rates.

Note 3. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills are included in "Unincorporated Areas."

As a result, we called 10 respondents at random that stated on survey form that they personally strengthened the garage door opening, and would not mind if we contacted them with questions. We asked them about structural work that had been completed on their garages, what motivated them to take this action, and how they found out how to do this structural work.

We estimate that 25-35% of respondents falsely reported that they had structurally strengthened their garages. Of these respondents some thought installing a new garage door or other nonstructural work on the garage qualified. Among respondents that had indeed strengthened the garage door opening, the work was done either because: the respondent was engaged in a remodel or other structural work on the home and a contractor on site suggested it, the respondent was an architect or contractor, or the garage was structurally damaged in a fire or in the 1989 Loma Prieta earthquake and was therefore brought up to current seismic building codes in the reconstruction.

By Census Tract

The percentage of homes owned by survey respondents that had been at least partially retrofitted varied by census tract between 12.9 % at the north edge of Concord, and 100.0% in San Francisco's Mission District. The other census tracts with the highest rates were located in central Alameda, the southern edge of Los Gatos, and in the Pacific Heights and Presidio Heights neighborhoods of San Francisco. In contrast, the census tracts with the lowest retrofit rates in homes owned by survey respondents were found in northern Concord, San Francisco's Eureka Valley, and western Santa Clara (refer to TABLE A19 – *Retrofit Rate by Census Tract*).

The percentage of survey respondents that acted to at least partially retrofit their homes also varied widely – from 0.0% in San Francisco's Eureka Valley and west-central Santa Clara to 71.2% in Berkeley's Thousand Oaks neighborhood. Census tracts with the highest rates included central Alameda, northern and western Berkeley, the southern edge of Los Gatos, Oakland's Piedmont Avenue district, and San Francisco's Pacific Heights, Presidio Heights, Ingleside Terrace, and Richmond District neighborhoods. Conversely, the census tracts with the lowest rates of owners that acted to at least partially structurally strengthen their homes included the northern edge of Concord, the western edge of Los Gatos, southwestern Richmond, north-central and southeastern San Jose, the northern edge of San Leandro, western Santa Clara, and south-central Santa Rosa.

TABLE A19 — Retrofit Rate by Census Tract^{1,2}

At Least Partial Retrofit		Owner Acted to Retrofit		Retrofit Before Purchase		City Tracts	Location of Tract
# Retrofit	% Retrofit	# Acted	% Acted	# PreRetro	% PreRetro		
93	78.8%	61	51.7%	40	33.9%	Alameda	
26	76.5%	19	55.9%	7	20.6%	4271.00	Fernside; NE edge of Alameda; NE of Lincoln
7	53.8%	3	23.1%	4	30.8%	4272.00	NE Alameda; On Tidal Canal; N of Park & Lincoln
15	83.3%	7	38.9%	9	50.0%	4277.00	S Alameda; On SF Bay & USN border; W of Webster
16	94.1%	12	70.6%	6	35.3%	4278.00	Central Alameda; SE of Webster & Lincoln
29	80.6%	20	55.6%	14	38.9%	4282.00	SE edge of Alameda; S of Park & Encinal
16	38.1%	10	23.8%	6	14.3%	Ashland-San Lorenzo	
10	47.6%	6	28.6%	4	19.0%	4340.00	Ashland; NW of I-580 & I-238 interchange
6	28.6%	4	19.0%	2	9.5%	4358.00	San Lorenzo; On San Leandro border west of I-880
149	82.8%	117	65.0%	51	28.3%	Berkeley	
53	89.8%	42	71.2%	18	30.5%	4212.00	Thousand Oaks; on fault; near Cragmont School
27	87.1%	22	71.0%	9	29.0%	4218.00	W of Gourmet Ghetto; Between MLK & Sacramento
31	83.8%	25	67.6%	12	32.4%	4219.00	Westbrae; On Albany border; BART line
12	75.0%	8	50.0%	5	31.3%	4221.00	Ocean View; NW of University & San Pablo
19	79.2%	14	58.3%	6	25.0%	4222.00	W Berkeley; NE of University & San Pablo
7	53.8%	6	46.2%	1	7.7%	4240.00	SW Berkeley; On Oakland border; SW of Ashby & MLK
31	28.7%	20	18.5%	15	13.9%	Concord	
4	12.9%	4	12.9%	0	0.0%	3290.00	N edge of Concord; S of Hwy 4
6	20.0%	6	20.0%	0	0.0%	3300.00	N Concord; NW of Port Chicago Hwy & Willow Pass
10	37.0%	5	18.5%	6	22.2%	3310.00	N central Concord; E of downtown; SE of Willow Pass
11	55.0%	5	25.0%	9	45.0%	3362.00	W central Concord; Next to Pleasant Hill; E of Hwy 242
17	53.1%	10	31.3%	7	21.9%	Crockett	
17	53.1%	10	31.3%	7	21.9%	3570.00	All of Crockett; includes Port Costa

TABLE A19 — Retrofit Rate by Census Tract (continued)

At Least Partial Retrofit		Owner Acted to Retrofit		Retrofit Before Purchase		City Tracts	Location of Tract
# Retrofit	% Retrofit	# Acted	% Acted	# PreRetro	% PreRetro		
45	42.1%	33	30.8%	19	17.8%	Daly City	
36	41.4%	25	28.7%	17	19.5%	6009.00	NW edge of Daly City; Next to SF; N of John Daly Blvd.
9	45.0%	8	40.0%	2	10.0%	6011.00	W Daly City; W of Broadmoor Village; E of Hwy 35
17	56.7%	9	30.0%	10	33.3%	Lexington Hills	
17	56.7%	9	30.0%	10	33.3%	5118.98	Large tract on county line; Includes Redwood Estates
37	82.2%	25	55.6%	16	35.6%	Los Gatos	
34	91.9%	24	64.9%	14	37.8%	5070.00	S edge of Los Gatos; SE of Hwy 17 & 9 interchange
3	37.5%	1	12.5%	2	25.0%	5071.00	W edge of Los Gatos; Next to Monte Sereno; W of 17
31	39.7%	16	20.5%	17	21.8%	Napa	
12	37.5%	6	18.8%	6	18.8%	2002.00	S Napa; E of Hwy 29 between 1st St. & Imola Ave.
11	57.9%	5	26.3%	7	36.8%	2004.00	E. Napa; W of 1st Ave. between Hagen & Coombsville
8	29.6%	5	18.5%	4	14.8%	2005.00	Central Napa; E of Hwy 29 between Trancas & 1st St.
108	75.0%	82	56.9%	38	26.4%	Oakland	
3	37.5%	3	37.5%	0	0.0%	4007.00	N Oakland; On Berkeley border; N of 52nd
18	90.0%	14	70.0%	6	30.0%	4041.00	Piedmont Ave.; NE of Broadway & 40th
22	78.6%	16	57.1%	8	28.6%	4042.00	Upper Rockridge; Includes cemetery; W of Hwy 13
36	75.0%	29	60.4%	11	22.9%	4045.02	Montclair; E of Hwy 13 & Thornhill Dr
2	66.7%	1	33.3%	1	33.3%	4061.00	W Fruitvale; On Alameda border; W of E 14th & High
20	80.0%	14	56.0%	8	32.0%	4068.00	Redwood Heights; Between Hwy 13 & MacArthur
7	58.3%	5	41.7%	4	33.3%	4104.00	SE Oakland; On San Leandro border; E of E 14th
101	62.3%	60	37.0%	48	29.6%	Palo Alto	
16	44.4%	8	22.2%	8	22.2%	5106.00	Far S Palo Alto; Next to Los Altos; SW of El Cam. Real
14	41.2%	7	20.6%	8	23.5%	5111.00	NW Palo Alto; On E Palo Alto border; SW of Hwy 101
26	72.2%	19	52.8%	9	25.0%	5112.00	N Palo Alto; Next to Menlo Park/E Palo Alto
16	80.0%	8	40.0%	10	50.0%	5113.98	Far NW Palo Alto; Next to Menlo Park; SW of Middlefield
29	80.6%	18	50.0%	13	36.1%	5114.98	Central Palo Alto; N of Oregon Exwy & Alma St.

TABLE A19 — Retrofit Rate by Census Tract (continued)

At Least Partial Retrofit		Owner Acted to Retrofit		Retrofit Before Purchase		City Tracts	Location of Tract
# Retrofit	% Retrofit	# Acted	% Acted	# PreRetro	% PreRetro		
59	58.4%	27	26.7%	42	41.6%	Richmond	
22	68.8%	8	25.0%	17	53.1%	3710.00	NE Richmond; Next to San Pablo; NW of I-80 & MacDnld
28	52.8%	15	28.3%	19	35.8%	3720.00	Far N centr. Richmond; On San Pablo border; E of 23rd
5	50.0%	1	10.0%	4	40.0%	3790.00	SW central Richmond; NW of Cutting Blvd. & Carlson
4	66.7%	3	50.0%	2	33.3%	3810.00	S central Richmond; NW of I-80 & Cutting Blvd.
120	73.6%	81	49.7%	50	30.7%	San Francisco	
12	92.3%	9	69.2%	3	23.1%	132.00	Pacific Heights; Next to Presidio; Betw. Lyon & Laguna
11	91.7%	8	66.7%	3	25.0%	133.00	Presidio Heights; Next to Presidio; North of California
1	16.7%	0	0.0%	1	16.7%	205.00	Eureka Valley; Betw. 17th & 21st, Castro & Douglass
15	78.9%	7	36.8%	9	47.4%	218.00	Glen Park; W of San Jose Ave. betw. 30th & Bosworth
9	100.0%	4	44.4%	5	55.6%	229.00	Mission District; Between Hwy. 101 & S Van Ness
2	33.3%	2	33.3%	1	16.7%	234.00	Bay View; On Candlestick Park boundary; SE of 3rd
7	53.8%	4	30.8%	6	46.2%	257.00	Portola/Silver Terrace; SW of I-280 & Hwy 101
6	85.7%	3	42.9%	4	57.1%	263.00	Crocker Amazon; Next to Daly City; SE of Mission
12	75.0%	9	56.3%	5	31.3%	308.00	West Portal; E of 19th between Taraval & San Francis
14	87.5%	11	68.8%	4	25.0%	309.00	Ingleside Terrace/Balboa Terrace; E of 19th Ave.
8	53.3%	7	46.7%	1	6.7%	327.00	Sunset; On Golden Gate Park; Betw. Sunset & 28th
6	54.5%	3	27.3%	4	36.4%	428.00	Seacliff; On Presidio & Pac. Ocean; NE of Calif. & 32nd
17	85.0%	14	70.0%	4	20.0%	478.00	Richmond; Between Fulton & Clement, 29th & 38th
87	57.2%	50	32.9%	45	29.6%	San Jose	
23	71.9%	13	40.6%	11	34.4%	5005.00	W of Downtown SJ; Near Santa Clara; SE of I-880
11	45.8%	5	20.8%	7	29.2%	5006.00	W of Downtown San Jose; E of Park & Naglee
8	30.8%	4	15.4%	4	15.4%	5011.00	N central SJ; Mile+ N of downtown; SE of E Taylor
7	70.0%	5	50.0%	3	30.0%	5015.00	Central San Jose; Mile+ east of downtown; SW of 101
2	28.6%	1	14.3%	1	14.3%	5016.00	SE of Downtown San Jose; E of S 1st & E William
36	67.9%	22	41.5%	19	35.8%	5024.00	Central San Jose; Mile 1/2 S of downtown; W of 87

TABLE A19 — Retrofit Rate by Census Tract (continued)

At Least Partial Retrofit		Owner Acted to Retrofit		Retrofit Before Purchase		City Tracts	Location of Tract
# Retrofit	% Retrofit	# Acted	% Acted	# PreRetro	% PreRetro		
57	52.8%	33	30.6%	30	27.8%	San Leandro	
18	81.8%	13	59.1%	7	31.8%	4322.00	N edge of San Leandro; Next to Oakland; E of E 14th
4	30.8%	1	7.7%	3	23.1%	4323.00	N edge of San Leandro; Next to Oakland; W of E 14th
13	40.6%	5	15.6%	9	28.1%	4325.00	NW San Leandro; Next to Oakland; N of I-880 & Marina
8	44.4%	4	22.2%	4	22.2%	4326.00	N SL; Next to Oakland; NW of Bancroft & Sybil
14	60.9%	10	43.5%	7	30.4%	4327.00	NE San Leandro; Near Oakland; Betw. I-580 & Bancroft
19	29.2%	9	13.8%	13	20.0%	Santa Clara	
2	11.8%	0	0.0%	2	11.8%	5053.04	W central Santa Clara; Betw. Monroe & El Camino Real
6	18.2%	5	15.2%	3	9.1%	5053.05	Far W SC; Next to Sunnyvale; N of El Camino Real
3	60.0%	2	40.0%	1	20.0%	5056.00	Downtown; Includes Mission & Univ.; S of El Cam. Real
8	80.0%	2	20.0%	7	70.0%	5057.00	Far E Santa Clara; Next to San Jose; E of Winchester
62	56.4%	21	19.1%	47	42.7%	Santa Rosa	
28	51.9%	7	13.0%	23	42.6%	1518.00	S central Santa Rosa; E of downtown; N of Hwy 12
5	38.5%	2	15.4%	4	30.8%	1519.00	S central Santa Rosa; S of downtown; SE of 101
25	67.6%	11	29.7%	17	45.9%	1522.00	Cent. Santa Rosa; N of dwntwn; NE of Mendocino
4	66.7%	1	16.7%	3	50.0%	1530.02	SW Santa Rosa; W of downtown; SW of 101 & College
5	50.0%	1	10.0%	4	40.0%	Other	Arrived with site address torn off survey
50	48.1%	29	27.9%	23	22.1%	Unincorporated Areas Cities	Ashland-San Lorenzo, Crockett, and Lexington Hills
999	60.9%	636	38.8%	475	28.9%		All other jurisdictions
1054	60.1%	665	37.9%	498	28.4%	Total	All jurisdictions

Note 1. The number of those who acted to at least partially retrofit added to the number of respondents whose homes were retrofitted before they were purchased, is slightly more than the total number of respondents with retrofitted homes because some owners both bought an already retrofitted home and acted to further strengthen it.

Note 2. Tracts with the highest retrofit rates are indicated with light shading, while those with the lowest retrofit rates are indicated with dark shading.

The rate of survey respondents that bought homes that had previously been retrofitted varied between 57.1% in the Crocker Amazon neighborhood in San Francisco,³ and 0.0% in several census tracts including two in northern Concord and one in North Oakland. Other census tracts with high rates included southern Alameda, the northwest edge of Palo Alto, northeastern Richmond, San Francisco's Mission District, and southwestern Santa Rosa. In contrast, census tracts with low percentages of homes of survey respondents that were retrofitted prior to being purchased by the current owner included southwest Berkeley and San Francisco's Sunset District.

Statistical Tests

All of these retrofit measures were found to be correlated to the city in which the home was located through performing chi square tests and logistic regressions (refer to TABLE A20 – *Determining Retrofit Rates by Knowing City: Statistical Analysis*). Knowing the city in which the home was located could correctly predict whether or not the home had been retrofitted and whether the home had a reasonably complete retrofit 60.11% and 54.72% of the time respectively. Additionally, the city was able to correctly predict whether or not the homeowner had at least acted to partially retrofitted in 62.18% of instances. Furthermore, knowing the city in which the home was located could correctly predict whether the home had been retrofitted prior to purchase and whether nonstructural measures had been taken 71.69% and 81.72% of the time respectively.

TABLE A20 – Determining Retrofit Rates by Knowing City^{1,2}
Statistical Analysis

Variable	Chi Square Test Significance Level	Logistic Regression		Conclusion Significant/ Not Significant
		Overall Ability of City to Predict Variable	Significance Level	
Home Partially Retrofitted	0.0000	60.11%	0.0000	Significant
Home Fully Retrofitted	0.0000	54.72%	0.0000	Significant
Owner Acted to Retrofit	0.0000	62.18%	0.0000	Significant
Retrofitted Before Purchase	0.1181	-	0.1192	Not Significant
Nonstructural Measures	0.0016	81.72%	0.0018	Significant

Note 1. "Home fully retrofitted" indicates that the home has a reasonably complete retrofit. "Owner acted to retrofit" indicates that the owner has acted to *at least partially* retrofit.

Note 2. A significance level of less than .05 indicates that there is a relationship between the variable and whether or not the homeowner acted to at least partially retrofit.

Note 3. An ability to correctly predict whether or not the owner had acted to at least partially retrofit 50% of the time would indicate that the variable has little or no correlation.

³ The data for Crocker Amazon may be misleading, however, because this census tract also had one of the lowest response rates.

EDUCATIONAL ATTAINMENT

By City

The educational attainment for all respondents averaged .809.⁴ Overall, the numbers for educational attainment were much higher than the figures from the 1990 Standard Tape File 3A from the U.S. Department of Commerce, Bureau of the Census (Census Bureau), with an average difference between survey numbers and census numbers of .239. According to the Census Bureau, Palo Alto should have had the highest educational attainment at .812, with Berkeley second at .663. Instead, Berkeley topped the charts with a .960 educational attainment in the homeowner survey, with Palo Alto second at .940 (refer to TABLE A21 – *Educational Attainment by City*).

TABLE A21 – Educational Attainment by City^{1,2,3,4}

Jurisdiction	Educational Attainment		
	Census Edu. Attainment	Survey Edu. Attainment	Difference in Edu. Attainment
Alameda	0.585	0.810	0.225
Berkeley	0.663	0.960	0.296
Concord	0.513	0.697	0.185
Daly City	0.546	0.803	0.257
Los Gatos	0.727	0.932	0.205
Napa	0.476	0.767	0.291
Oakland	0.617	0.874	0.257
Palo Alto	0.812	0.940	0.128
Richmond	0.446	0.692	0.246
San Francisco	0.578	0.819	0.241
San Jose	0.448	0.755	0.307
San Leandro	0.468	0.710	0.241
Santa Clara	0.520	0.722	0.202
Santa Rosa	0.528	0.814	0.286
Other	--	0.850	--
Unincorporated Areas	0.507	0.682	0.175
Cities	0.573	0.817	0.244
Total	0.570	0.809	0.239

Note 1. Difference in Educational Attainment" is the difference when subtracting census educational attainment from survey educational attainment.

Note 2. Census totals are based on totals for selected census tracts, not the city as a whole.

Note 3. The scores for educational attainment were determined by using the formula: $[(\# \text{ didn't finish high school}) * 0 + (\# \text{ high school graduates}) * .5 + (\# \text{ college graduates}) * 1] / (\text{total } \# \text{ of respondents})$.

Note 4. Light shading indicates the highest educational attainment or the greatest difference in educational attainment; dark shading indicates the lowest educational attainment or the smallest difference.

Note 5. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills is included in "Unincorporated Areas."

⁴ The score for educational attainment for both census and survey data was determined by using the formula: $((\# \text{ didn't finish high school}) * 0 + (\# \text{ high school graduates}) * .5 + (\# \text{ college graduates}) * 1) / (\text{total } \# \text{ of people})$. In determining the census totals for each city, we only looked at the census tracts studied, and not the average city data which are available from the census.

Richmond, which according to Census Bureau data had the lowest educational attainment of the cities surveyed at .446, was also lowest in the survey with a .692 educational attainment. Concord had the second lowest educational attainment, according to the survey, at .697

This difference between survey and census data can most likely be explained by the type of respondents that would respond to our survey. The survey was composed of fairly complex questions, and as seen earlier, homeowners with a greater educational attainment were more likely to retrofit. Therefore, homeowners with higher levels of educational attainment would be more likely to answer this survey, because this work is now of interest to them. Moreover, many of the census tracts with high educational attainment also had high response rates. As a result, cities could be over-represented by tracts with high educational attainment and high response rates when calculating city averages, and therefore give little weight to tracts with low response rates and lower educational attainment.

By Census Tract

Educational attainment by census tract as calculated from the survey varied between 1.000 and .400. Three tracts scored a 1.000 educational attainment, signifying that all the survey respondents had graduated from college. These were found in northwest Berkeley's Ocean View neighborhood, western Fruitvale in Oakland, and San Francisco's Presidio Heights. However, the western Fruitvale tract as well as the Bay View tract in San Francisco – which had the lowest educational attainment of all the tracts in the survey at .400 – were also two of the tracts with the lowest response rates. The Census Bureau's data on educational attainment of the western Fruitvale tract, in fact shows that this tract has one of the lowest levels of educational attainment of those studied at .296. Other tracts with the highest educational attainment included the Thousand Oaks and Westbrae neighborhoods in northern Berkeley. Besides San Francisco's Bay View tract, census tracts which were found to have the lowest educational attainment in the survey included tracts in southwestern Richmond and in San Francisco's Crocker Amazon neighborhood (refer to TABLE A22 – *Educational Attainment by Census Tract*).

TABLE A22 — Educational Attainment by Census Tract^{1,2,3}

Educational Attainment			City Tracts	Location of Tract
Census Edu. Attain.	Survey Edu. Attain.	Edu. Attain. Difference		
0.585	0.810	0.225	Alameda	
0.632	0.824	0.192	4271.00	Fernside; NE edge of Alameda; NE of Lincoln
0.526	0.625	0.099	4272.00	NE Alameda; On Tidal Canal; N of Park & Lincoln
0.624	0.781	0.157	4277.00	S Alameda; On SF Bay & USN border; W of Webster
0.573	0.882	0.309	4278.00	Central Alameda; SE of Webster & Lincoln
0.573	0.838	0.265	4282.00	SE edge of Alameda; S of Park & Encinal
0.425	0.613	0.188	Ashland-San Lorenzo	
0.412	0.553	0.141	4340.00	Ashland; NW of I-580 & I-238 interchange
0.436	0.667	0.231	4358.00	San Lorenzo; On San Leandro border west of I-880
0.663	0.960	0.296	Berkeley	
0.902	0.983	0.080	4212.00	Thousand Oaks; on fault; near Cragmont School
0.808	0.935	0.127	4218.00	W of Gourmet Ghetto; Between MLK & Sacramento
0.695	0.971	0.277	4219.00	Westbrae; On Albany border; BART line
0.506	1.000	0.494	4221.00	Ocean View; NW of University & San Pablo
0.697	0.955	0.258	4222.00	W Berkeley; NE of University & San Pablo
0.441	0.833	0.392	4240.00	SW Berkeley; On Oakland border; SW of Ashby & MLK
0.513	0.697	0.185	Concord	
0.514	0.694	0.180	3290.00	N edge of Concord; S of Hwy 4
0.501	0.690	0.189	3300.00	N Concord; NW of Port Chicago Hwy & Willow Pass
0.528	0.740	0.212	3310.00	N central Concord; E of downtown; SE of Willow Pass
0.506	0.658	0.152	3362.00	W central Concord; Next to Pleasant Hill; E of Hwy 242
0.536	0.655	0.119	Crockett	
0.536	0.655	0.119	3570.00	All of Crockett; includes Port Costa

TABLE A22 — Educational Attainment by Census Tract (continued)

Educational Attainment			City Tracts	Location of Tract
Census Edu. Attain.	Survey Edu. Attain.	Edu. Attain. Difference		
0.546	0.803	0.257	Daly City	
0.555	0.823	0.268	6009.00	NW edge of Daly City; Next to SF; N of John Daly Blvd.
0.539	0.706	0.167	6011.00	W Daly City; W of Broadmoor Village; E of Hwy 35
0.658	0.800	0.142	Lexington Hills	
0.658	0.800	0.142	5118.98	Large tract on county line; Includes Redwood Estates
0.727	0.932	0.205	Los Gatos	
0.739	0.946	0.207	5070.00	S edge of Los Gatos; SE of Hwy 17 & 9 interchange
0.687	0.857	0.170	5071.00	W edge of Los Gatos; Next to Monte Sereno; W of 17
0.476	0.767	0.291	Napa	
0.453	0.776	0.323	2002.00	S Napa; E of Hwy 29 between 1st St. & Imola Ave.
0.562	0.789	0.228	2004.00	E. Napa; W of 1st Ave. between Hagen & Coombsville
0.464	0.740	0.276	2005.00	Central Napa; E of Hwy 29 between Trancas & 1st St.
0.617	0.874	0.257	Oakland	
0.427	0.500	0.073	4007.00	N Oakland; On Berkeley border; N of 52nd
0.712	0.975	0.263	4041.00	Piedmont Ave.; NE of Broadway & 40th
0.766	0.944	0.178	4042.00	Upper Rockridge; Includes cemetery; W of Hwy 13
0.836	0.924	0.088	4045.02	Montclair; E of Hwy 13 & Thornhill Dr
0.296	1.000	0.704	4061.00	W Fruitvale; On Alameda border; W of E 14th & High
0.570	0.848	0.277	4068.00	Redwood Heights; Between Hwy 13 & MacArthur
0.396	0.583	0.187	4104.00	SE Oakland; On San Leandro border; E of E 14th
0.812	0.940	0.128	Palo Alto	
0.746	0.929	0.183	5106.00	Far S Palo Alto; Next to Los Altos; SW of El Cam. Real
0.829	0.941	0.112	5111.00	NW Palo Alto; On E Palo Alto border; SW of Hwy 101
0.841	0.956	0.115	5112.00	N Palo Alto; Next to Menlo Park/E Palo Alto
0.808	0.900	0.092	5113.98	Far NW Palo Alto; Next to Menlo Park; SW of Middlefield
0.867	0.958	0.092	5114.98	Central Palo Alto; N of Oregon Exwy & Alma St.

TABLE A22 — Educational Attainment by Census Tract (continued)

Educational Attainment			City Tracts	Location of Tract
Census Edu. Attain.	Survey Edu. Attain.	Edu. Attain. Difference		
0.446	0.692	0.246	Richmond	
0.516	0.719	0.203	3710.00	NE Richmond; Next to San Pablo; NW of I-80 & MacDnld
0.492	0.731	0.239	3720.00	Far N centr. Richmond; On San Pablo border; E of 23rd
0.337	0.444	0.107	3790.00	SW central Richmond; NW of Cutting Blvd. & Carlson
0.428	0.583	0.156	3810.00	S central Richmond; NW of I-80 & Cutting Blvd.
0.578	0.819	0.241	San Francisco	
0.826	0.833	0.008	132.00	Pacific Heights; Next to Presidio; Betw. Lyon & Laguna
0.812	1.000	0.188	133.00	Presidio Heights; Next to Presidio; North of California
0.745	0.833	0.088	205.00	Eureka Valley; Betw. 17th & 21st, Castro & Douglass
0.681	0.921	0.240	218.00	Glen Park; W of San Jose Ave. betw. 30th & Bosworth
0.364	0.500	0.136	229.00	Mission District; Between Hwy. 101 & S Van Ness
0.338	0.400	0.062	234.00	Bay View; On Candlestick Park boundary; SE of 3rd
0.362	0.667	0.305	257.00	Portola/Silver Terrace; SW of I-280 & Hwy 101
0.450	0.429	-0.022	263.00	Crocker Amazon; Next to Daly City; SE of Mission
0.707	0.781	0.074	308.00	West Portal; E of 19th between Taraval & San Francis
0.680	0.938	0.258	309.00	Ingleside Terrace/Balboa Terrace; E of 19th Ave.
0.585	0.808	0.223	327.00	Sunset; On Golden Gate Park; Betw. Sunset & 28th
0.815	0.955	0.140	428.00	Seacliff; On Presidio & Pac. Ocean; NE of Calif. & 32nd
0.580	0.947	0.367	478.00	Richmond; Between Fulton & Clement, 29th & 38th
0.448	0.755	0.307	San Jose	
0.611	0.871	0.260	5005.00	W of Downtown SJ; Near Santa Clara; SE of I-880
0.537	0.783	0.246	5006.00	W of Downtown San Jose; E of Park & Naglee
0.339	0.500	0.161	5011.00	N central SJ; Mile+ N of downtown; SE of E Taylor
0.220	0.500	0.280	5015.00	Central San Jose; Mile+ east of downtown; SW of 101
0.426	0.857	0.431	5016.00	SE of Downtown San Jose; E of S 1st & E William
0.601	0.827	0.226	5024.00	Central San Jose; Mile 1/2 S of downtown; W of 87

TABLE A22 — Educational Attainment by Census Tract (continued)

Educational Attainment			City Tracts	Location of Tract
Census Edu. Attain.	Survey Edu. Attain.	Edu. Attain. Difference		
0.468	0.710	0.241	San Leandro	
0.550	0.795	0.245	4322.00	N edge of San Leandro; Next to Oakland; E of E 14th
0.472	0.792	0.319	4323.00	N edge of San Leandro; Next to Oakland; W of E 14th
0.404	0.625	0.221	4325.00	NW San Leandro; Next to Oakland; N of I-880 & Marina
0.458	0.588	0.130	4326.00	N SL; Next to Oakland; NW of Bancroft & Sybil
0.542	0.795	0.253	4327.00	NE San Leandro; Near Oakland; Betw. I-580 & Bancroft
0.520	0.722	0.202	Santa Clara	
0.483	0.765	0.282	5053.04	W central Santa Clara; Betw. Monroe & El Camino Real
0.507	0.710	0.203	5053.05	Far W SC; Next to Sunnyvale; N of El Camino Real
0.487	0.500	0.013	5056.00	Downtown; Includes Mission & Univ.; S of El Cam. Real
0.580	0.800	0.220	5057.00	Far E Santa Clara; Next to San Jose; E of Winchester
0.528	0.814	0.286	Santa Rosa	
0.591	0.875	0.284	1518.00	S central Santa Rosa; E of downtown; N of Hwy 12
0.470	0.885	0.415	1519.00	S central Santa Rosa; S of downtown; SE of 101
0.590	0.691	0.101	1522.00	Cent. Santa Rosa; N of dwntwn; NE of Mendocino
0.403	0.833	0.431	1530.02	SW Santa Rosa; W of downtown; SW of 101 & College
--	0.850	--	Other	Arrived with site address torn off survey
0.507	0.682	0.175	Unincorporated Areas	Ashland-San Lorenzo, Crockett, and Lexington Hills
0.573	0.817	0.244	Cities	All other jurisdictions
0.570	0.809	0.239	Total	All jurisdictions

Note 1. "Educational Attainment Difference" is the difference when subtracting census educational attainment from survey educational attainment.

Note 2. Census totals based on totals for selected census tracts, not the city as a whole. The score for educational attainment was determined by using the formula: $((\# \text{ didn't finish high school}) * 0 + (\# \text{ high school graduates}) * .5 + (\# \text{ college graduates}) * 1) / (\text{total } \# \text{ of respondents})$.

Note 3. Tracts with the highest educational attainment or largest differences in educational attainment are indicated with light shading; tracts with the lowest educational attainment or smallest differences in educational attainment are indicated with dark shading.

HOUSEHOLD INCOME

By City

Mean household income was found to be \$64,745 in the homeowner survey, and \$62,792 from the Census Bureau data.⁵ Income as calculated through the survey was in most cases higher than that found in the data from the Census Bureau. Los Gatos, which had the highest income as reported by the Census Bureau with \$104,529, was also found to have the highest survey income with \$90,658. Likewise, Palo Alto had the second highest income reported by the Census Bureau with \$103,286, and the second highest survey respondent income with \$87,710 (refer to TABLE A23 – *Household Income by City*).

TABLE A23 – Household Income by City^{1,2,3,4}

Jurisdiction	Household Mean Income		
	Census Income	Survey Income	Difference in Income
Alameda	\$57,532	\$61,649	\$4,117
Berkeley	\$56,087	\$72,949	\$16,861
Concord	\$48,367	\$54,462	\$6,095
Daly City	\$50,640	\$59,315	\$8,675
Los Gatos	\$104,529	\$90,658	-\$13,871
Napa	\$42,403	\$55,224	\$12,820
Oakland	\$61,386	\$70,474	\$9,088
Palo Alto	\$103,286	\$87,710	-\$15,576
Richmond	\$61,386	\$50,787	-\$10,600
San Francisco	\$81,488	\$67,944	-\$13,544
San Jose	\$54,879	\$64,462	\$9,583
San Leandro	\$42,064	\$53,105	\$11,041
Santa Clara	\$58,977	\$66,538	\$7,561
Santa Rosa	\$43,876	\$56,837	\$12,961
Other	--	\$72,500	--
Unincorporated Areas	\$53,047	\$53,182	\$135
Cities	\$63,285	\$65,492	\$2,208
Total	\$62,792	\$64,745	\$1,952

Note 1. "Difference in Income" is the difference when subtracting census income from survey income.

Note 2. Incomes were determined by the formula: $[(\# \text{ with income } < \$20\text{K}) * \$15,000 + (\# \text{ with income } \$20\text{-}40\text{K}) * \$30,000 + (\# \text{ with income } \$40\text{-}60\text{K}) * \$50,000 + (\# \text{ with income } \$60\text{-}80\text{K}) * \$70,000 + (\# \text{ with income } \$80\text{-}100\text{K}) * \$90,000 + (\# \text{ with income } > \$100\text{K}) * \$110,000] / (\# \text{ total respondents})$.

Note 3. Light shading indicates cities with the highest income; dark shading indicates cities with the lowest.

Note 4. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills is included in "Unincorporated Areas."

⁵ The mean household income was calculated from the survey data through the following formula: $[(\# \text{ with income under } \$20,000) * \$15,000 + (\# \text{ with income } \$20\text{-}\$40,000) * \$30,000 + (\# \text{ with income } \$40\text{-}\$60,000) * \$50,000 + (\# \text{ with income } \$60\text{-}\$80,000) * \$70,000 + (\# \text{ with income } \$80\text{-}\$100,000) * \$90,000 + (\# \text{ with income over } \$100,000) * \$110,000] / (\# \text{ of respondents})$. In determining the census totals for each city, we only looked at the census tracts studied, and not the average city data which are available from the census.

Richmond was found to have the lowest survey income with \$50,787, which oddly is \$11,000 lower than the City's income reported by the Census Bureau. San Leandro, which had the lowest income reported by the Census Bureau of all the cities in the survey at \$42,064, was found to have the second lowest survey respondent income with \$53,105.

Household income may have been inflated through the survey compared to the census data for the same reason that educational attainment was inflated – homeowners with higher incomes were more likely to retrofit, and therefore to respond to the survey. However, the survey figures probably underestimate income in the highest earning areas like Los Gatos and Palo Alto. Here, the majority of homeowners earn over \$100,000. In our formula for calculating mean household income from survey data, we estimated that anyone earning over \$100,000 a year was earning \$110,000, which isn't nearly as high as many of the homeowners in these cities earn.

By Census Tract

The mean household income per census tract in the survey varied between \$104,000 in Pacific Heights and \$20,000 in Bay View, both in San Francisco. Northwestern and central Palo Alto and San Francisco's Presidio Heights and Seacliff neighborhoods were the sites of the other census tracts found to have the highest incomes in the survey. North Oakland, southwestern Richmond, and San Francisco's Mission District and Crocker Amazon neighborhoods were found to have the lowest incomes. San Francisco was exceedingly diverse with incomes at both ends of the spectrum (refer to TABLE A24 – *Household Income by Census Tract*).

RESPONSES TO SURVEY QUESTIONS BY CITY

Survey questions answers were also broken down by city (refer to TABLE A25 – *Responses to Survey Questions by City*).

Decade Home Built

Alameda and Berkeley had the most homes built before 1950 with 94.6% and 91.8% of homes built in this time period respectively. Santa Clara had the fewest number of homes of survey respondents built before 1950 with 22.6%.

As stated previously, we determined that it may have been easier for homes built before 1950 to have been deemed partially retrofitted. To meet our definition of partially retrofitted, a home built before 1950 only needed to have either been bolted to the foundation *or* have had plywood installed. Homes built in or after 1950, however, were assumed to have already been bolted to the foundation during their original construction, and instead had to have plywood installed to be deemed a retrofit. Therefore, Alameda and Berkeley high rates of retrofit might be due to the large amount of survey respondents owning pre-1950s housing.

TABLE A24 — Household Income by Census Tract ^{1,2,3}

Household Mean Income			City Tracts	Location of Tract
Census Income	Survey Income	Difference in Income		
\$57,532	\$61,649	\$4,117	Alameda	
\$58,975	\$64,815	\$5,840	4271.00	Fernside; NE edge of Alameda; NE of Lincoln
\$47,388	\$41,000	-\$6,388	4272.00	NE Alameda; On Tidal Canal; N of Park & Lincoln
\$67,594	\$55,000	-\$12,594	4277.00	S Alameda; On SF Bay & USN border; W of Webster
\$64,828	\$70,357	\$5,529	4278.00	Central Alameda; SE of Webster & Lincoln
\$51,616	\$64,828	\$13,212	4282.00	SE edge of Alameda; S of Park & Encinal
\$39,688	\$41,944	\$2,256	Ashland-San Lorenzo	
\$36,981	\$44,444	\$7,463	4340.00	Ashland; NW of I-580 & I-238 interchange
\$41,109	\$39,444	-\$1,665	4358.00	San Lorenzo; On San Leandro border west of I-880
\$56,087	\$72,949	\$16,861	Berkeley	
\$89,641	\$89,783	\$142	4212.00	Thousand Oaks; on fault; near Cragmont School
\$56,767	\$64,630	\$7,863	4218.00	W of Gourmet Ghetto; Between MLK & Sacramento
\$48,334	\$78,088	\$29,754	4219.00	Westbrae; On Albany border; BART line
\$35,806	\$57,692	\$21,886	4221.00	Ocean View; NW of University & San Pablo
\$44,585	\$59,130	\$14,545	4222.00	W Berkeley; NE of University & San Pablo
\$34,291	\$56,923	\$22,632	4240.00	SW Berkeley; On Oakland border; SW of Ashby & MLK
\$48,367	\$54,462	\$6,095	Concord	
\$47,821	\$57,200	\$9,379	3290.00	N edge of Concord; S of Hwy 4
\$49,297	\$53,519	\$4,222	3300.00	N Concord; NW of Port Chicago Hwy & Willow Pass
\$52,186	\$53,125	\$939	3310.00	N central Concord; E of downtown; SE of Willow Pass
\$42,266	\$53,824	\$11,558	3362.00	W central Concord; Next to Pleasant Hill; E of Hwy 242
\$49,206	\$49,231	\$25	Crockett	
\$49,206	\$49,231	\$25	3570.00	All of Crockett; includes Port Costa

TABLE A24 — Household Income by Census Tract (continued)

Household Mean Income			City Tracts	Location of Tract
Census Income	Survey Income	Difference in Income		
\$50,640	\$59,315	\$8,675	Daly City	
\$52,818	\$60,625	\$7,807	6009.00	NW edge of Daly City; Next to SF; N of John Daly Blvd.
\$48,819	\$55,000	\$6,181	6011.00	W Daly City; W of Broadmoor Village; E of Hwy 35
\$78,401	\$72,692	-\$5,709	Lexington Hills	
\$78,401	\$72,692	-\$5,709	5118.98	Large tract on county line; Includes Redwood Estates
\$104,529	\$90,658	-\$13,871	Los Gatos	
\$108,966	\$90,758	-\$18,208	5070.00	S edge of Los Gatos; SE of Hwy 17 & 9 interchange
\$80,451	\$90,000	\$9,549	5071.00	W edge of Los Gatos; Next to Monte Sereno; W of 17
\$42,403	\$55,224	\$12,820	Napa	
\$37,322	\$61,296	\$23,974	2002.00	S Napa; E of Hwy 29 between 1st St. & Imola Ave.
\$56,237	\$61,176	\$4,939	2004.00	E. Napa; W of 1st Ave. between Hagen & Coombsville
\$39,168	\$43,696	\$4,528	2005.00	Central Napa; E of Hwy 29 between Trancas & 1st St.
\$61,386	\$70,474	\$9,088	Oakland	
\$33,778	\$31,667	-\$2,111	4007.00	N Oakland; On Berkeley border; N of 52nd
\$49,439	\$74,211	\$24,772	4041.00	Piedmont Ave.; NE of Broadway & 40th
\$71,626	\$89,167	\$17,541	4042.00	Upper Rockridge; Includes cemetery; W of Hwy 13
\$89,368	\$71,471	-\$17,897	4045.02	Montclair; E of Hwy 13 & Thornhill Dr
\$32,508	\$42,500	\$9,992	4061.00	W Fruitvale; On Alameda border; W of E 14th & High
\$48,907	\$65,000	\$16,093	4068.00	Redwood Heights; Between Hwy 13 & MacArthur
\$40,363	\$56,364	\$16,001	4104.00	SE Oakland; On San Leandro border; E of E 14th
\$103,286	\$87,710	-\$15,576	Palo Alto	
\$76,342	\$74,483	-\$1,859	5106.00	Far S Palo Alto; Next to Los Altos; SW of El Cam. Real
\$91,015	\$97,407	\$6,392	5111.00	NW Palo Alto; On E Palo Alto border; SW of Hwy 101
\$130,303	\$84,821	-\$45,482	5112.00	N Palo Alto; Next to Menlo Park/E Palo Alto
\$96,418	\$82,368	-\$14,050	5113.98	Far NW Palo Alto; Next to Menlo Park; SW of Middlefield
\$137,268	\$98,571	-\$38,697	5114.98	Central Palo Alto; N of Oregon Exwy & Alma St.

TABLE A24 — Household Income by Census Tract (continued)

Household Mean Income			City Tracts	Location of Tract
Census Income	Survey Income	Difference in Income		
\$61,386	\$50,787	-\$10,600	Richmond	
\$40,639	\$54,828	\$14,189	3710.00	NE Richmond; Next to San Pablo; NW of I-80 & MacDnld
\$37,566	\$54,444	\$16,878	3720.00	Far N centr. Richmond; On San Pablo border; E of 23rd
\$28,737	\$24,500	-\$4,237	3790.00	SW central Richmond; NW of Cutting Blvd. & Carlson
\$31,529	\$47,000	\$15,471	3810.00	S central Richmond; NW of I-80 & Cutting Blvd.
\$81,488	\$67,944	-\$13,544	San Francisco	
\$190,653	\$104,000	-\$86,653	132.00	Pacific Heights; Next to Presidio; Betw. Lyon & Laguna
\$183,918	\$92,222	-\$91,696	133.00	Presidio Heights; Next to Presidio; North of California
\$72,668	\$63,000	-\$9,668	205.00	Eureka Valley; Betw. 17th & 21st, Castro & Douglass
\$66,101	\$73,824	\$7,723	218.00	Glen Park; W of San Jose Ave. betw. 30th & Bosworth
\$42,865	\$28,571	-\$14,294	229.00	Mission District; Between Hwy. 101 & S Van Ness
\$41,379	\$20,000	-\$21,379	234.00	Bay View; On Candlestick Park boundary; SE of 3rd
\$43,311	\$45,556	\$2,245	257.00	Portola/Silver Terrace; SW of I-280 & Hwy 101
\$49,036	\$28,000	-\$21,036	263.00	Crocker Amazon; Next to Daly City; SE of Mission
\$86,900	\$64,667	-\$22,233	308.00	West Portal; E of 19th between Taraval & San Francis
\$102,584	\$75,417	-\$27,167	309.00	Ingleside Terrace/Balboa Terrace; E of 19th Ave.
\$49,852	\$54,545	\$4,693	327.00	Sunset; On Golden Gate Park; Betw. Sunset & 28th
\$153,741	\$100,000	-\$53,741	428.00	Seacliff; On Presidio & Pac. Ocean; NE of Calif. & 32nd
\$53,672	\$69,231	\$15,559	478.00	Richmond; Between Fulton & Clement, 29th & 38th
\$54,879	\$64,462	\$9,583	San Jose	
\$73,938	\$81,852	\$7,914	5005.00	W of Downtown SJ; Near Santa Clara; SE of I-880
\$58,533	\$68,333	\$9,800	5006.00	W of Downtown San Jose; E of Park & Naglee
\$42,809	\$38,095	-\$4,714	5011.00	N central SJ; Mile+ N of downtown; SE of E Taylor
\$34,808	\$34,444	-\$364	5015.00	Central San Jose; Mile+ east of downtown; SW of 101
\$61,796	\$54,000	-\$7,796	5016.00	SE of Downtown San Jose; E of S 1st & E William
\$55,661	\$71,200	\$15,539	5024.00	Central San Jose; Mile 1/2 S of downtown; W of 87

TABLE A24 — Household Income by Census Tract (continued)

Household Mean Income			City Tracts	Location of Tract
Census Income	Survey Income	Difference in Income		
\$42,064	\$53,105	\$11,041	San Leandro	
\$47,323	\$53,947	\$6,624	4322.00	N edge of San Leandro; Next to Oakland; E of E 14th
\$40,816	\$55,833	\$15,017	4323.00	N edge of San Leandro; Next to Oakland; W of E 14th
\$39,143	\$45,862	\$6,719	4325.00	NW San Leandro; Next to Oakland; N of I-880 & Marina
\$38,710	\$44,412	\$5,702	4326.00	N SL; Next to Oakland; NW of Bancroft & Sybil
\$46,947	\$70,278	\$23,331	4327.00	NE San Leandro; Near Oakland; Betw. I-580 & Bancroft
\$58,977	\$66,538	\$7,561	Santa Clara	
\$64,240	\$63,529	-\$711	5053.04	W central Santa Clara; Betw. Monroe & El Camino Real
\$59,288	\$68,542	\$9,254	5053.05	Far W SC; Next to Sunnyvale; N of El Camino Real
\$49,973	\$50,000	\$27	5056.00	Downtown; Includes Mission & Univ.; S of El Cam. Real
\$55,996	\$73,125	\$17,129	5057.00	Far E Santa Clara; Next to San Jose; E of Winchester
\$43,876	\$56,837	\$12,961	Santa Rosa	
\$46,865	\$58,191	\$11,326	1518.00	S central Santa Rosa; E of downtown; N of Hwy 12
\$34,236	\$59,615	\$25,379	1519.00	S central Santa Rosa; S of downtown; SE of 101
\$51,213	\$53,594	\$2,381	1522.00	Cent. Santa Rosa; N of dwntwn; NE of Mendocino
\$33,297	\$57,500	\$24,203	1530.02	SW Santa Rosa; W of downtown; SW of 101 & College
--	\$72,500	--	Other	Arrived with site address torn off survey
\$53,047	\$53,182	\$135	Unincorporated Areas	Ashland-San Lorenzo, Crockett, and Lexington Hills
\$63,285	\$65,492	\$2,208	Cities	All other jurisdictions
\$62,792	\$64,745	\$1,952	Total	All jurisdictions

Note 1. "Difference in Income" is the difference when subtracting census mean income from survey mean income.

Note 2. Survey income was determined by the formula: $[(\# \text{ with income } < \$20\text{K}) * 15,000 + (\# \text{ with income } \$20\text{-}40\text{K}) * 30,000 + (\# \text{ with income } \$40\text{-}60\text{K}) * 50,000 + (\# \text{ with income } \$60\text{-}80\text{K}) * 70,000 + (\# \text{ with income } \$80\text{-}100\text{K}) * 90,000 + (\# \text{ with income } > \$100\text{K}) * 110,000)] / (\# \text{ total respondents})$

Note 3. Tracts with the highest incomes or largest differences in income (either positive or negative) are indicated with light shading; tracts with the 1. or smallest differences in income are indicated with dark shading.

TABLE A25 — Responses to Survey Questions by City ¹

	<i>Jurisdictions</i>															
	<i>Ala- meda</i>	<i>Berk- eley</i>	<i>Con- cord</i>	<i>Daly City</i>	<i>Los Gatos</i>	<i>Napa</i>	<i>Oak- land</i>	<i>Palo Alto</i>	<i>Rich- mond</i>	<i>San Fran- cisco</i>	<i>San Jose</i>	<i>San Lean- dro</i>	<i>Santa Clara</i>	<i>Santa Rosa</i>	<i>Unin- corp. Areas</i>	<i>Total</i>
Home built <1950	94.6%	91.8%	30.5%	16.3%	79.5%	68.4%	69.6%	68.8%	68.8%	91.1%	80.0%	74.8%	22.6%	79.4%	79.4%	70.5%
Home built 1950+	5.4%	8.2%	69.5%	83.7%	20.5%	31.6%	30.4%	31.2%	31.3%	8.9%	20.0%	25.2%	77.4%	20.6%	20.6%	29.5%
Non-structural work	90.7%	86.7%	67.6%	91.6%	97.8%	69.2%	80.6%	87.7%	80.2%	87.7%	79.6%	72.2%	80.0%	81.8%	68.3%	81.8%
Very/mod hi EQ risk	84.5%	73.3%	26.5%	56.4%	75.0%	24.7%	74.8%	60.8%	41.1%	36.4%	54.9%	58.1%	34.4%	56.7%	59.2%	55.8%
Very/mod low EQ risk	15.5%	26.7%	73.5%	43.6%	25.0%	75.3%	25.2%	39.2%	58.9%	63.6%	45.1%	41.9%	65.6%	43.3%	40.8%	44.2%
Friend has acted	60.9%	59.2%	9.5%	23.1%	66.7%	15.4%	47.1%	36.9%	20.2%	45.7%	31.0%	31.4%	7.9%	17.8%	27.0%	35.3%
Lives in home	88.7%	88.7%	77.6%	89.5%	88.6%	75.6%	92.1%	92.5%	81.8%	89.3%	81.8%	92.5%	81.0%	85.3%	90.9%	87.1%
Rents home	9.6%	11.3%	20.6%	10.5%	11.4%	23.1%	7.9%	7.5%	16.2%	10.1%	16.9%	7.5%	19.0%	13.8%	8.1%	12.2%
Has EQ insurance	32.2%	39.8%	7.6%	39.0%	59.1%	16.7%	39.1%	38.4%	18.8%	22.6%	25.2%	23.1%	18.8%	26.4%	28.4%	29.2%
Did have EQ insur.	21.7%	26.7%	18.1%	25.7%	13.6%	6.4%	29.0%	23.3%	18.8%	21.9%	15.0%	30.8%	26.6%	26.4%	26.5%	22.6%
Never had EQ insur.	46.1%	33.5%	74.3%	35.2%	27.3%	76.9%	31.9%	38.4%	62.5%	55.5%	59.9%	46.2%	54.7%	47.3%	45.1%	48.2%
No high school	3.5%	0.0%	4.8%	2.5%	0.0%	8.2%	5.1%	0.6%	13.1%	6.5%	10.2%	6.7%	4.7%	3.7%	7.1%	5.1%
High school graduate	31.0%	8.0%	51.0%	44.3%	13.6%	30.1%	14.7%	11.2%	35.4%	22.1%	28.6%	44.8%	46.9%	29.0%	49.5%	28.4%
Graduated college	65.5%	92.0%	44.2%	53.2%	86.4%	61.6%	80.1%	88.2%	51.5%	71.4%	61.2%	48.6%	48.4%	67.3%	43.4%	66.5%
Calc. educ. attain.	81.8%	96.5%	68.7%	79.4%	93.2%	76.0%	88.9%	93.4%	73.0%	84.3%	79.0%	71.6%	71.1%	80.0%	68.2%	80.1%
Age of owner <35	8.0%	4.0%	9.4%	6.1%	2.3%	10.7%	8.8%	5.7%	7.1%	5.8%	9.3%	11.3%	10.9%	6.7%	11.8%	7.8%
Age of owner 35-64	56.0%	74.0%	61.3%	48.0%	79.5%	58.7%	69.3%	63.1%	55.6%	54.8%	69.3%	57.5%	65.6%	59.0%	60.8%	62.5%
Age of owner 65+	36.0%	22.0%	29.2%	45.9%	18.2%	30.7%	21.9%	31.2%	37.4%	39.4%	21.3%	31.1%	23.4%	34.3%	27.5%	29.8%
Income <\$40K	34.5%	20.5%	28.0%	28.8%	10.5%	37.3%	22.4%	11.5%	46.1%	27.4%	28.5%	38.9%	23.5%	34.0%	39.8%	28.1%
Income \$40-80K	45.2%	33.3%	55.9%	46.6%	15.8%	43.3%	36.2%	19.8%	37.1%	31.5%	33.8%	41.1%	43.1%	42.3%	39.8%	36.9%
Income \$80K+	20.2%	46.2%	16.1%	24.7%	73.7%	19.4%	41.4%	68.7%	16.9%	41.1%	37.7%	20.0%	33.3%	23.7%	20.5%	35.0%
Calc. mean income	\$61,649	\$72,949	\$54,462	\$59,315	\$90,658	\$55,224	\$70,474	\$87,710	\$50,787	\$67,944	\$64,462	\$53,105	\$66,538	\$56,837	\$53,182	\$64,745

Note 1. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills is included in "Unincorporated Areas."

Note 2. Cities with the highest percentage of respondents with this answer are designated with light shading. Cities with the lowest percentage are designated with dark shading.

Nonstructural Measures

Respondents in Los Gatos were most likely to live in homes in which nonstructural work had been completed with 97.8% of respondents taking these measures. Daly City followed with 91.6%. Conversely, Concord and the unincorporated areas, with 67.6% and 68.3% respectively, were least likely to have homes in which these measures have been taken.

Risk Perception

Respondents in Alameda – much of which is on Bay mud or fill which amplifies shaking in an earthquake – retained the greatest risk perception of all the cities. This was followed by Los Gatos, which experienced damage from the 1989 Loma Prieta earthquake. Again, Concord and the unincorporated areas perceived the least amount of risk.

Knows Someone Who Has Acted

The percentage of respondents who knew someone that had acted to structurally retrofit was exceedingly low in Santa Clara with 7.9% of homeowners, and Concord with 9.5%. These were also two cities that have exceedingly low retrofit rates. On the other hand, Los Gatos had the highest percentage of survey respondents who knew someone that had acted to retrofit at 66.7%. Alameda retained the second highest percentage at 60.9%.

Owners and Renters

At 75.6%, Napa had the lowest percentage of respondents who lived in the home targeted in the survey. Concord's percentage was the second lowest at 77.6%; low ownership rates could help to explain these cities' low retrofit rates since the variables are correlated. However, San Leandro, which is tied with Palo Alto for the highest ownership rate at 92.5%, had a below average retrofit rate.

Earthquake Insurance

Berkeley and Los Gatos, which are the two cities with the highest percentages of respondents that have retrofitted, also are the two cities with the highest rates of owners that currently possess earthquake insurance.

Educational Attainment

Berkeley and Palo Alto had the highest percentages of respondents that had graduated from college at 92.0% and 88.2% respectively. On the other hand, the two jurisdictions with the lowest rates were the unincorporated areas with 43.4% and Concord with 44.2%.

Age of Owner

Los Gatos and Berkeley had an exceedingly high number of homeowners that were between the ages of 35 and 64, at 79.5% and 74.0% respectively. San Leandro had the highest percentage of homeowners below the age of 35 with 11.3%, followed by the unincorporated areas with 11.8%. Because acting to at least partially retrofit was found to be inversely related to whether the homeowner was younger than 35, it makes sense that San Leandro and the unincorporated areas retained below average retrofit rates.

Household Income

Survey respondents in Los Gatos and Palo Alto earned the highest mean incomes of all the cities studied with \$90,658 and \$87,710 per year respectively. According to the survey, 46.1% of the respondents in Richmond earn less than \$40,000 a year. Richmond also had fairly low levels of educational attainment. Although previously we found that higher income and greater educational attainment were directly related to whether the homeowner retrofitted, Richmond never emerged as a city with an extremely low retrofit rate. It may be because of the publicized danger of living on the northern Hayward fault.

REASONS STRUCTURAL WORK DONE OR NOT DONE

The reasons for homeowners acting or not acting to at least partially retrofit were also identified by city (refer to TABLE A26 – *Reasons Structural Work Done/Not Done by Jurisdiction*).

Reasons Structural Work Done

Knows Someone Who Has Acted

Respondents in Alameda and Santa Rosa were the most likely of all the cities to have acted to at least partially retrofit because they knew someone else who had also acted, with 16.7% of respondents in each city citing this reason. In Napa and Richmond, on the other hand, 0.0% of respondents mentioned this reason.

Concerned About Damaging Earthquakes in Neighborhood

Berkeley and San Leandro, at 71.3% and 68.0% respectively, were the cities that were most likely to have respondents that acted to at least partially retrofit because a damaging earthquake could strike the home's neighborhood. In addition to these cities, the majority of respondents in Alameda, Oakland, and Richmond – which are also located on the Hayward fault – cited this reason. This concern was least felt in Concord and Santa Clara, where 14.3% of respondents in each city claimed this reason.

Helped by City/County

San Leandro emerged here as the city that most influenced residents to retrofit with 24.0% of respondents stating that the City's help was the reason they retrofitted. Santa Clara had the second highest number of respondents with 14.3% who gave this reason, even though the City doesn't have a program to encourage retrofitting. Berkeley came in third in this category, with 8.7% of homeowners citing the City's help as their reason to structurally strengthen their homes. Conversely, in many cities, including the unincorporated areas, no respondents at all gave this answer.

Damage in Past Earthquake

Santa Clara and Los Gatos respondents were most likely to retrofit as a result of past earthquake damage with 42.9% and 24.0% respectively, citing this as their reason for retrofitting.

TABLE A26 — Reasons Structural Work Done/Not Done by City^{1,2}

	<i>Jurisdictions</i>															
	<i>Ala- meda</i>	<i>Berk- eley</i>	<i>Con- cord</i>	<i>Daly City</i>	<i>Los Gatos</i>	<i>Napa</i>	<i>Oak- land</i>	<i>Palo Alto</i>	<i>Rich- mond</i>	<i>San Fran- cisco</i>	<i>San Jose</i>	<i>San Lean- dro</i>	<i>Santa Clara</i>	<i>Santa Rosa</i>	<i>Unin- corp. Areas</i>	<i>Total</i>
<i>Did work because:</i>																
Friend did work	16.7%	14.8%	15.4%	4.0%	7.4%	0.0%	12.5%	12.1%	0.0%	14.5%	5.0%	8.0%	14.3%	16.7%	4.0%	11.5%
Risk of EQ in area	58.3%	71.3%	14.3%	40.0%	55.6%	18.2%	62.5%	53.4%	50.0%	46.4%	45.0%	68.0%	14.3%	50.0%	36.0%	54.2%
City/county helped	3.3%	8.7%	7.7%	0.0%	7.4%	0.0%	0.0%	5.2%	7.1%	1.4%	0.0%	24.0%	14.3%	0.0%	0.0%	4.5%
Damage in past EQ	1.7%	2.6%	7.7%	0.0%	24.0%	0.0%	1.4%	1.8%	0.0%	1.5%	22.5%	0.0%	42.9%	22.2%	12.0%	5.7%
<i>No work because:</i>																
No one else has	18.6%	14.3%	27.6%	24.7%	19.2%	30.0%	16.5%	20.6%	11.3%	25.7%	23.4%	27.9%	26.3%	21.3%	12.7%	21.4%
Unsure what to do	31.4%	35.4%	43.7%	43.8%	30.8%	53.3%	35.9%	39.3%	43.8%	45.5%	47.6%	44.2%	50.9%	49.4%	38.0%	42.8%
Costs too much	30.2%	37.1%	33.3%	33.7%	23.1%	55.0%	35.9%	21.5%	38.8%	31.3%	45.2%	47.7%	36.8%	44.9%	48.1%	37.7%
EQ no prob in neigh.	4.7%	5.7%	33.3%	11.2%	3.8%	31.7%	3.9%	12.1%	15.0%	11.1%	11.3%	8.1%	24.6%	6.7%	6.3%	12.2%
Intimidated by city	5.8%	7.6%	8.0%	5.6%	3.8%	10.0%	10.7%	7.5%	8.8%	15.2%	9.7%	10.5%	1.8%	6.7%	17.7%	8.7%

Note 1. For each jurisdiction the universe of respondents is those giving answers to why they did retrofit work or why they did not do retrofit work.

Note 2. Data for Ashland-San Lorenzo, Crockett, and Lexington Hills is included in "Unincorporated Areas."

Reasons Structural Work Not Done

Doesn't Know Someone Who Has Acted

As before, respondents in Napa were most likely to have not retrofitted because they didn't know someone else who had. This reason was cited among 30.0% of the City's respondents. This reason was second most common amongst San Leandro respondents of whom 27.9% cited this reason.

Doesn't Know What to Do

Napa and Santa Clara had the highest number of respondents who gave this answer with 53.3% and 50.9% respectively who stated that they had not acted to at least partially retrofit because they were unsure what to do.

Costs Too Much

The two cities with the highest incomes in the survey and in the census data, Los Gatos and Palo Alto, also had the lowest number of respondents that had not acted to at least partially retrofit because of the cost with 23.1% and 21.5% homeowners respectively.

Earthquakes Not a Problem in Neighborhood

At 33.3%, survey respondents living in Concord were most likely to state that they had not retrofitted because earthquakes were not a problem in their neighborhood, followed by 31.7% among Napa respondents.

Intimidated by City/County

The highest number of respondents that hadn't retrofitted because they were intimidated by their local government were found in the unincorporated areas with 17.7%. San Francisco was second with 15.2%, and many of the other large cities of the region were also at the high end of the spectrum. This reason was least cited in Santa Clara where 1.8% of respondents gave this answer, and in Los Gatos where 3.8% of respondents stated that they were intimidated by their local government.

STATISTICAL TESTS

Chi square tests and logistic regressions were run between the cities in which the homes were located and the above variables (refer to TABLE A27 – *Determining Other Variables by Knowing City: Statistical Analysis*). Only the following variables were found to be correlated by city: risk perception, whether the owner knows someone who has acted, and the owner's educational attainment. Additionally, among the reasons detailed above regarding why the owner did or did not do the retrofit work only three of the reasons were found to be correlated with the cities. These were: fear of a future earthquake in the neighborhood, completing retrofit work because of damage in a past earthquake, and not executing a retrofit because of the cost.

TABLE A27 – Determining Other Variables by Knowing City ^{1,2}
Statistical Analysis

Variable	Chi Square Test	Logistic Regression		Conclusion Significant/ Not Significant
	Significance Level	Overall Ability of City to Predict Variable	Significance Level	
Decade Home Built	0.3106	-	0.3101	Not Significant
EQ Risk Perception	0.0000	55.09%	0.0000	Significant
Friend Has Acted	0.0000	65.04%	0.0000	Significant
Lives/Rents Home	0.7567	-	0.7566	Not Significant
Has EQ Insurance	0.0801	-	0.0804	Not Significant
Educational Attainment	0.0000	66.85%	0.0000	Significant
Age of Owner	0.0525	-	0.0561	Not Significant
Income	0.0599	-	0.0602	Not Significant
Bought Because Retrofitted	0.9035	-	0.9035	Not Significant
Did work because:				
Knew person who did	0.1044	-	0.1057	Not Significant
Potential EQ in neighb.	0.0037	56.30%	0.0039	Significant
City/county helped	0.3598	-	0.3610	Not Significant
Damage in past EQ	0.0005	93.44%	0.0010	Significant
Didn't do work because:				
No one else has	0.7670	-	0.7672	Not Significant
Unsure what to do	0.0637	-	0.0644	Not Significant
Costs too much	0.0047	62.33%	0.0050	Significant
EQ no prob in neighb.	0.3387	-	0.3373	Not Significant
Intimidated by city/county	0.0638	-	0.0677	Not Significant

Note 1. A significance level of less than .05 indicates that there is a relationship between the variable and whether or not the homeowner acted to at least partially retrofit.

Note 2. An ability to correctly predict whether or not the owner had acted at least partially 50% of the time would indicate that the variable has little or no correlation.

Logistic regressions were run to see if by knowing in what city the homeowner lived another variable could be correctly predicted. By knowing the city it was found that the owner's educational attainment and whether or not the owner knew someone who had retrofitted could be correctly predicted 66.85% and 65.04% of the time respectively. Also notable, it was found that knowing the city could correctly predict 93.44% of the cases in which the homeowner had cited that retrofit work had been done because of damage from a previous earthquake.

EFFECTIVENESS OF BERKELEY AND SAN LEANDRO'S RETROFIT PROGRAMS

OVERVIEW OF DATA

As we saw previously, in Berkeley an exceedingly high 65.0% of respondents acted to at least partially retrofit their homes. This number was 34.4% higher than San Leandro's rate of 30.6%. Of the 27 respondents that stated that they did the structural work because the City or County helped them, 10 lived in Berkeley and 6 lived in San Leandro. Overall, however, 24.0% of San Leandro respondents stated that they did the retrofit work because of help from the City, compared to 8.7% of Berkeley respondents. Furthermore, many San Leandro respondents enthusiastically replied about the help the City offered, and had glowing remarks about the program.

BERKELEY, SAN LEANDRO, AND ALAMEDA RETROFIT COMPARISON

Despite this data we still couldn't determine the effectiveness of the programs, and we were concerned about the effect of other variables on the retrofit rates. As a result, we compared the rates of homeowners who acted to at least partially retrofit their homes in Berkeley, San Leandro, and Alameda, and their responses to different variables. Alameda was included because we believed that it was a comparable nearby city in the East Bay on the Hayward fault (refer to TABLE A28 – *Comparison of Owners Acting to at Least Partially Retrofit in Berkeley and San Leandro*).

Even among houses built before 1950, Berkeley still had a higher retrofit rate, with 68.2% of homeowners who lived in these homes acting to at least partially retrofit, over San Leandro's 35.0%. Again, in looking at risk perception, Berkeley had the highest rate of homeowners acting to at least partially structurally retrofit their homes, with the highest percentages of retrofit in all ranges of lowest to highest risk perception. When both respondents in Berkeley and San Leandro knew someone who had done structural work, Berkeley still had a higher rate of owners acting to at least partially retrofit with 67.5% compared to San Leandro's 56.3%. However, San Leandro had a higher rate of homeowners retrofitting when they didn't know someone who had done retrofit work at 43.8%.

Among college graduates, Berkeley's rate of homeowners acting to at least partially strengthen their homes was almost 30% higher than San Leandro, with 67.9% compared to San Leandro's 39.2%. Berkeley was almost 15% higher than San Leandro when looking at the retrofit rate among high school graduates. The rate of respondents acting to at least partially retrofit in Berkeley was also higher than San Leandro in all income brackets except the very lowest. Berkeley's retrofit rate was over 35% higher than San Leandro's in the very highest income category with 73.1% to San Leandro's 37.5%. Interestingly, Alameda's retrofit rate appeared to stay relatively constant across all income categories.

TABLE A28 – Comparison of Owners Acting to at Least Partially Retrofit in Berkeley and San Leandro ¹

	Acted to at Least Partially Retrofit Home			
	Decade Home Built			
	<i>Home Built Before 1950</i>		<i>Home Built In Or After 1950</i>	
Berkeley	107	68.2%	5	35.7%
San Leandro	28	35.0%	5	18.5%
Alameda	56	53.3%	4	66.7%

	Acted to at Least Partially Retrofit Home							
	Earthquake Risk Perception							
	<i>Very High</i>		<i>Moderately High</i>		<i>Moderately Low</i>		<i>Very Low</i>	
Berkeley	38	69.1%	55	74.3%	20	51.3%	2	25.0%
San Leandro	8	33.3%	14	37.8%	8	22.9%	2	22.2%
Alameda	24	57.1%	27	52.9%	8	50.0%	0	0.0%

	Acted to at Least Partially Retrofit Home			
	Knows/Doesn't Know Someone That Has Retrofitted			
	<i>Friend Also Did Structural Work</i>		<i>No Friend Did Structural Work</i>	
Berkeley	77	67.5%	37	32.5%
San Leandro	18	56.3%	14	43.8%
Alameda	41	68.3%	19	31.7%

	Acted to at Least Partially Retrofit Home					
	Educational Attainment					
	<i>Did Not Complete High School</i>		<i>Graduated From High School</i>		<i>Graduated From College</i>	
Berkeley	0	0.0%	5	35.7%	108	67.9%
San Leandro	2	28.6%	10	21.3%	20	39.2%
Alameda	0	0.0%	22	62.9%	38	51.4%

	Acted to at Least Partially Retrofit Home											
	Family Income Per Year											
	<i>Less than \$20,000</i>		<i>\$20,000 to \$39,000</i>		<i>\$40,000 to \$59,000</i>		<i>\$60,000 to \$79,000</i>		<i>\$80,000 to \$99,000</i>		<i>\$100,000 or More</i>	
Berkeley	3	25.0%	13	68.4%	16	57.1%	15	62.5%	14	70.0%	38	73.1%
San Leandro	5	33.3%	4	18.2%	3	13.6%	5	29.4%	6	54.5%	3	37.5%
Alameda	6	54.5%	9	50.0%	9	52.9%	12	57.1%	4	40.0%	9	52.9%

Note 1. The first number in each column refers to the total number of respondents that acted to at least partially retrofit their home, lived in the designated city, and also gave this answer. The second number is the percentage of respondents that acted to at least partially retrofit of those that lived in their respective cities that gave that answer.

San Leandro's retrofit rate did not appear to stand out in any of the categories. It was thought that perhaps people in San Leandro might *know* what to do to retrofit their homes from the classes and assistance available from the City, despite homeowners not yet acting to do the structural work. However, the percentage of respondents in San Leandro

who stated that they hadn't done structural work because they didn't know what to do was 44.2%, higher than the overall average. As a result, San Leandro's program probably makes people feel good about the structural work they've completed, but it hasn't been used by a large enough number of people to significantly increase the overall retrofit rate among San Leandro respondents.

Unlike San Leandro, Berkeley had very high retrofit rates. However, it was difficult to tell if Berkeley's high rate of homeowners acting to at least partially retrofit was because of the City's program or because of something else unique about living in Berkeley.

TIME AFTER PURCHASE UNTIL RETROFITTED

We hypothesized that Berkeley's program should increase the rate of homeowners acting to retrofit their homes, particularly in the first year after purchase. As a result, we looked at the amount of time it took homeowners to retrofit after moving into their homes. We subtracted the first date of retrofit work from the deed transfer date (refer to TABLE A29 – *Amount of Time it Took Owner to Retrofit After Purchase of Home*).

TABLE A29 - Amount of Time it Took Owner to Retrofit After Purchase of Home

Jurisdiction	Percentage Acting to Retrofit Home in 1 Year or Less After Purchase		Ratio of Percentage Acting to Retrofit Within 1 Year of Home Purchase Before vs. After 1991	Average Number of Years Respondent Took to Begin Retrofit After Purchase		Ratio of Number of Years Before Acting After Purchase for Homes Purchased Before vs. After 1991
	Purchased in 1991 or earlier	Purchased After 1991		Purchased in 1991 or earlier	Purchased After 1991	
Berkeley	23.9%	50.0%	2.1	8.4	1.1	7.7
All Others	34.3%	36.9%	1.1	7.0	1.5	4.8

Note 1. "Acting to retrofit" indicates that the owner has acted to *at least partially* retrofit.

In Berkeley and in jurisdictions overall, the percentage of respondents acting to at least partially retrofit within one year of purchasing their homes increased after 1991. This may be due to the 1989 Loma Prieta earthquake, because of increased information being released to the public regarding earthquake risk, or due to increased earthquake insurance rates.

Among Berkeley respondents, of those purchasing their home in 1991 or before, 23.9% had acted to at least partially retrofit their home in one year of less after purchase, while this was true of 50.0% of respondents who had purchased their homes after 1991. There was only a slight increase among all other jurisdictions with 34.3% of respondents who had purchased their homes in or before 1991 retrofitting within the first year of purchase, and 36.9% retrofitting among those with homes purchased after 1991. In Berkeley, the percentage of those who acted to at least partially retrofit within one year of purchase after 1991 was 2.1 times the percentage of those in 1991 or before, while in all other

cities this rate was 1.1 times as high. The ratio difference between these rates shows that there was an actual increase of 19.4% in the percentage of respondents in Berkeley who had acted to at least partially retrofit in one year or less *over the regional average*.

Overall, cities were found to have decreased the average number of years the respondent acted to at least partially retrofit the home after moving in. Among all cities but Berkeley, survey respondents took on average 1.5 years to retrofit for homes purchased after 1991, and 7.0 years for homes purchased in or before 1991. Thus, respondents living in cities other than Berkeley who had purchased their homes after 1991 were 4.8 times faster in retrofitting than those purchasing their homes before. For homes purchased after 1991, Berkeley respondents took an average of 1.1 years to retrofit after purchasing the home, compared to 8.4 years in homes built in 1991 or before. Hence, Berkeley respondents who purchased their home after 1991 were 7.7 times faster in acting to at least partially retrofit their homes. The ratio difference between these rates shows that there was an actual increase of 60.5% in the percentage of respondents who retrofitted in fewer years on average in Berkeley than the regional average.

The percentage of respondents acting to at least partially retrofit within the first year of home purchase increased and the average number of years respondents began retrofitting after purchase decreased among homes that had been purchased after 1991 for all jurisdictions. These changes were most marked after 1991 in Berkeley, with statistically significant increases in the percentage of respondents to retrofit and statistically significant decreases in the average number of years respondents began retrofitting after purchase over the regional average. Therefore, Berkeley's program appears to have been effective because the program increased the rate of homeowners acting to retrofit, particularly within the first year of purchase, which the Berkeley program targets.

PROGRAM EFFECTIVENESS CONCLUSIONS

Berkeley and San Leandro both have innovative programs, and they likely contributed in some way to their cities' rates of homeowners acting to retrofit. However, while Berkeley's program had a significant impact on retrofit rates, San Leandro's program did not.

Residents in Berkeley may have retrofitted at relatively high rates without financial incentives if risk perception remained high due to high educational attainment. Perhaps very visible retrofits of Berkeley's City Hall and the Cragmont Elementary School have contributed to this high-risk perception and partially contributed to residential retrofit rates.

In Berkeley, 15% of respondents who acted to at least partially retrofit cited the City's help as a motivating factor among those purchasing their homes after 1991. In addition, there was a 19% increase in Berkeley over the rest of the region in the percentage of respondents who acted to at least partially retrofit after 1991 – when Berkeley's retrofit program went into effect. As a result, the program is potentially responsible for a 15-19% increase in the number of people retrofitting their homes.

San Leandro's program did not seem to have a large impact on the retrofit rate of the City as a whole. The City's program appears to be weakest in instilling a belief in earthquake risk and in providing financial incentives for homeowners unable or unwilling to do the work themselves.

CONCLUSIONS

FACTORS MOST INFLUENCING RETROFIT

We found that *all* of the variables tested were correlated with whether the homeowner had acted to at least partially retrofit. Whether the homeowner had a friend that also retrofitted, household income, and educational attainment were probably the most important variables for determining retrofit rates. The factors most influencing whether or not the owner has acted to at least partially retrofit are as follows (in no specific order):

- ◆ Home built before 1950
- ◆ Home has been renovated
- ◆ Nonstructural measures have been taken
- ◆ Lived in current home in 1989
- ◆ Experienced major earthquake
- ◆ Very to moderately high earthquake risk perception
- ◆ Knows someone that has retrofitted ("the lemming effect")
- ◆ Has seen ABAG maps
- ◆ Lives in home rather than rents
- ◆ Has earthquake insurance
- ◆ Has food and water for 3+ days
- ◆ Is college graduate
- ◆ Is 35+ years old
- ◆ Household income \$80,000+

REASONS STRUCTURAL WORK DONE OR NOT DONE

Reasons Structural Work Done

The most common responses to why the owner had decided to do structural work are below in order of importance (from TABLE A6 – *Responses to Questions*):

- ◆ I wanted to feel safer
- ◆ I am concerned about damaging earthquakes in this home's neighborhood
- ◆ I thought it was a good investment, or a good selling point
- ◆ I became concerned after earthquake scientists talked about Bay Area earthquakes

Reasons Structural Work Not Done

The most common responses to why the owner had decided **not** to do structural work are in order of importance (from TABLE A6 – *Responses to Questions*) as follows:

- ◆ I don't know what I need to do
- ◆ I think it **costs too much** for me to do
- ◆ I haven't gotten around to it
- ◆ I don't know anyone else who has done it

DESIGNING A MODEL RETROFIT PROGRAM FOR A CITY/COUNTY

A model retrofit program should be multi-faceted and address all the key variables that were found here to be large contributors to whether homeowners acted to at least partially retrofit – risk perception, knowing someone that has retrofitted, knowing how to retrofit, educational attainment, and income.

Risk Perception

Because residents with higher perceptions of risk tended to retrofit their homes in greater numbers, a model program should disseminate more information regarding earthquake risk. This would not necessarily come from cities, but could be addressed by organizations such as the U.S. Geological Survey, California Division of Mines and Geology, or ABAG at the regional level. Cities could then make this information neighborhood specific with outreach or neighborhood earthquake preparedness meetings. City programs to retrofit their own public structures can also increase risk perception.

Knowing Someone That Has Retrofitted

Knowing someone else that had retrofitted was directly related to whether homeowners acted to at least partially retrofit; therefore a program should encourage this “lemming effect.” One way would be to emulate San Leandro’s recent efforts to encourage residents to put a City-made sign in their front yard after retrofitting their home with the City’s help. Such a sign would simply state that the owner has retrofitted the home, and to call the City for more information. Because “graduates” of San Leandro’s program are enthusiastic about it afterwards, as noted previously in this study, they would likely accommodate such a sign in their yard. Such an element in San Leandro’s program before this survey might have had increased the retrofit rate, especially since respondents in San Leandro had one of the highest rates of respondents who hadn’t retrofitted because they didn’t know anyone else who had.

Knowing How to Retrofit

Respondents at all levels of educational attainment cited that they had not retrofitted because they didn’t know what to do. It is critical that a model program sufficiently inform the homeowner on how to go about retrofitting the home. A good example of such

a program element is in San Leandro where the City offers a series of five 2-hour construction workshops to help residents do the bolting and bracing of their homes on their own.

Educational Attainment

Because homeowners that have had more education are more likely to act to retrofit, a model program should target homeowners without college degrees. Such a program could target information to be broadcast on television, instead of newspaper articles as has been the case in the past. Also, more attention should be made to making this information more visual- and map-oriented.

The highest proportion of respondents who had supplies of food and water for four or more days were found to be in the group with the lowest educational attainment. Therefore, perhaps more outreach should be executed by disaster preparedness organizations such as the Red Cross and the California Office of Emergency Services, which have apparently had a stronger effect in this demographic. Such organizations would be invaluable resources to building departments in dispensing advice in getting homeowners to retrofit.

Income

Finally, a model program should address the issue of income. The survey found that homeowners with higher incomes were more likely to act to at least partially structurally strengthen their homes. Although we can't increase homeowners' income, we *can* decrease the cost to retrofit. Berkeley's tax transfer program was a good idea, but it will be difficult to institute in other cities because any increase in property transfer tax is subject to a two-thirds voter approval by Proposition 218. For instance, a program focusing on home purchase could encourage homeowners to borrow money at the time of home purchase to pay for a retrofit, incorporating this cost into the mortgage. This policy is beneficial for the bank since it reduces the risk in the chance of an earthquake, as well as beneficial for the homeowner. San Leandro's program lessens the cost of retrofit through the training of homeowners to do the work themselves. However, this incentive was found to be not as effective as monetary incentives.

TRANSFERABILITY

To expand the scope of this survey, it might be useful to create focus groups. One group of particular interest is households that earn less than \$20,000 per year yet *have* retrofitted their homes.

With the exceptions of minor modifications needed for questions A, C, and E – which dealt with questions specific to the Bay Area – this survey could easily be mailed to several hundred Southern California residents, especially in the Los Angeles area, or to residents of the Seattle-Tacoma metropolitan area. Data from such surveys could be used

to check the applicability of this survey's results and conclusions to other areas of the country.

ATTACHMENTS

The attachments include:

1-The blue four-page survey sent to homeowners.

2-Three postcards mailed to homeowners – a reminder postcard and additional postcards sent to Napa and Richmond. The reminder postcard was sent after the original survey. After the second copy of the survey was mailed out, additional postcards were sent to Napa and Richmond because of their particularly low response rates. The mayor's offices in these cities agreed to allow us to state on these postcards that responding to the survey would be helpful to the city at large.

3-A letter that was sent to homeowners in medium-sized cities with a second copy of the survey. Similar letters were crafted for San Francisco, Oakland, San Jose, North Bay cities, and unincorporated areas.

Bay Area Earthquake Safety SURVEY

Cuestionario sobre Seguridad durante Terremotos

The Association of Bay Area Governments (ABAG) is working with Bay Area cities and counties to improve earthquake safety programs. As part of this work, we are conducting this survey of Bay Area residents. Your answers are being combined with those of others to develop statistics on how prepared we are for future earthquakes. Your participation will help us design programs to help our cities be better prepared. Less than 1 in every 200 households is being sent this survey, so your answers are very valuable to us.

Please help us by taking a few minutes to answer the questions. After finishing the survey, mail it back to ABAG in the envelope provided. **No stamp or postage is necessary.** This survey is paid for by the National Science Foundation and the cities and counties of the Bay Area. Thank you.

Please answer the following questions about your home at:

La Asociación de Gobiernos de la Bahía (ABAG) está trabajando con ciudades y condados en la Bahía para mejorar programas de seguridad en tiempo de terremoto por medio de este cuestionario. Sus respuestas son muy importantes para nosotros. Si prefiere dar sus respuestas por teléfono con alguien que habla español, llame 510-464-7917 y deje su nombre y número de teléfono. Alguien lo llamará de vuelta. Gracias.

灣區政府協會正與灣區的縣市合作，藉著進行這項調查改善地震安全方案，您的意見對我們來說非常寶貴。若您偏好透過電話以國語或廣東話回答這些問題，請打 510-464-7917，留下您的大名和電話號碼，將會有人回覆您的電話。

Hiệp Hội Công Quyền Vùng Vịnh (The Association of Bay Area Governments) hiện đang hợp tác với các Quận Hạt và Thành Phố trong vùng để thăm dò hầu cải tiến các chương trình an toàn chống động đất. Do đó các ý kiến của bạn trong bản thăm dò này rất cần thiết.

Nếu bạn gặp khó khăn trong Anh ngữ, xin vui lòng nhờ bạn bè hoặc người thân giúp điền vào bảng thăm dò này và gửi lại cho chúng tôi.

Bạn có cần người thông dịch không?

Xin đánh dấu vào ô thích hợp: ☐ Có ☐ Không

PART I -

1. How many stories high is this home (above ground, including parking) _____ (Fill in number)
2. Is there living area (office, bedrooms, living room, etc.) above a garage? **Check ONE.**
☐ Yes ☐ No
3. What is the approximate decade this home was originally built? _____ (1950s, etc.)
4. Has this home been substantially changed with a major renovation? **Check ONE.**
☐ Yes ☐ No
5. Which of the following precautions have been taken for this home, and when did they occur?
These are called **nonstructural** measures. **Check ONE for EACH precaution.**
 - a. The water heater is braced or strapped to the wall?
☐ Yes, before I bought the home ☐ Yes, after I bought the home ☐ No
 - b. The chimney(s) is braced?
☐ Yes, before I bought the home ☐ Yes, after I bought the home ☐ No chimneys ☐ No
 - c. A special gas shut-off valve triggered by shaking or a gas leak detector is installed?
☐ Yes, before I bought the home ☐ Yes, after I bought the home ☐ No
6. Which of the following **structural** measures have been taken for your home, and when did they occur? **Check ONE for EACH precaution.**
 - d. The home is bolted to its foundation?
☐ Yes, before I bought the home ☐ Yes, after I bought the home ☐ No
 - e. Plywood has been added in the crawl space?
☐ Yes, before I bought the home ☐ Yes, after I bought the home ☐ No crawl space ☐ No
 - f. Additional strengthening of the garage door opening has occurred?
☐ Yes, before I bought the home ☐ Yes, after I bought the home ☐ No garage or detached ☐ No
7. For those responses **in Question 6** where no structural work has occurred, why have you decided **not** to do that work on **this** home? _____

Check ALL that apply and CIRCLE the one most important reason.

 - ☐ I don't know anyone else who has done it.
 - ☐ I don't know what I need to do.
 - ☐ I think it's too **hard** to do.
 - ☐ I think it **costs too much** for me to do.
 - ☐ I don't think that earthquakes are much of a problem in this home's neighborhood.
 - ☐ I do not have the ability to get or repay the loan required to pay for the work.
 - ☐ I think it's a bad investment.
 - ☐ I haven't gotten around to it.
 - ☐ I was afraid or intimidated by the City or County such as the building or planning department.
 - ☐ I'm afraid my property taxes will go up if I do it.
 - ☐ I know I'm not going to own my home for very long.
 - ☐ I have earthquake insurance instead.
 - ☐ Other _____

8. If any earthquake strengthening was done before you purchased the home, was it a factor in your decision to purchase this home? **Check ONE.**
☐ Yes, a lot ☐ Somewhat ☐ Not much ☐ Not at all ☐ Not applicable

If any earthquake STRUCTURAL (see Question 6) strengthening has been done on this home while you've owned it, continue with questions 9-14. Otherwise, skip to Part II.

9. Date(s) work was done: _____ (Fill in year. If you've done more than one strengthening project, list years.)
10. Who did the retrofit work? **Check ONE.**
☐ I did all the work myself.
☐ I hired a contractor to do the work.
☐ I did some of the work myself, but also hired a contractor.
11. How did you pay for the work? **Check ALL that apply.**
☐ Loan or refinance ☐ Cash or credit card.
☐ Support from a government program _____ (explain)
12. Did you hire or talk with a civil/structural engineer or architect prior to retrofitting this home? **Check ONE.** ☐ Yes ☐ No

13. Approximately how much money did you spend on the retrofit work? \$ _____

14. Why did you decide to do the **structural** work? _____

- ☐ I knew someone else, such as a friend, who had also strengthened their home.
☐ I am concerned about damaging earthquakes in this home's neighborhood.
☐ I found out about a problem when I bought the home.
☐ I got a letter or call from a contractor offering to do the work.
☐ I thought it was a good investment, or a good selling point.
☐ The City or County (such as building or planning staff) helped me. (How? _____)
☐ I knew my property taxes would NOT go up if I did this.
☐ I thought that I could retrofit my home and not need earthquake insurance.
☐ I did the work because the home was damaged in an earthquake.
☐ I found out I would get a discount on my earthquake insurance.
☐ I was concerned after I saw damage to homes in an earthquake.
☐ I became concerned after earthquake scientists talked about Bay Area earthquakes.
☐ I wanted to feel safer.
☐ Other _____

Check ALL that apply and CIRCLE the one most important reason.

PART II - The following questions will help us classify your responses and are OPTIONAL.

A. Where did you live in 1989 when the Loma Prieta earthquake happened? Check ONE.

- ☐ In this home
☐ Not in this home, but in California _____ (City name)
☐ Outside of California

B. Have you ever experienced a major damaging earthquake? Check ONE.

- ☐ Yes ☐ No

C. What do you believe is the risk a **major** earthquake will affect this home's neighborhood? Check ONE.

- ☐ Very High ☐ Moderately Low
☐ Moderately High ☐ Very Low

D. Do you know someone (such as a friend or neighbor) who has done additional **structural** work on their home to provide for additional safety in an earthquake? Check ONE.

- ☐ Yes ☐ No (For examples, see Question #6.)

E. Have you seen ABAG's earthquake shaking hazard maps for your city? Check ONE.

- ☐ Yes ☐ No

F. Do you live in this home? Check ONE.

- ☐ Yes ☐ No, I rent it out ☐ No, it is vacant

G. Do you have earthquake insurance for **this** home? Check ONE.

- ☐ Yes
☐ No, but I used to. I stopped paying for insurance in _____ (year).
☐ No, I have never purchased earthquake insurance for this home.

H. Do you have food and water at **your** home to help you survive after an earthquake? Check ONE.

- ☐ Yes, for more than 4 days ☐ Yes, for 1-2 days
☐ Yes, for 3-4 days ☐ No

I. How much school have you completed? Check HIGHEST degree received.

- ☐ I attended school, but did not complete High School (12th grade).
☐ I graduated from High School (or equivalent, such as GED).
☐ I graduated from college (Bachelor's degree or higher).

J. How old are you? Check ONE.

- ☐ Younger than 35 ☐ 35 to 64 years old ☐ 65 or older

K. What is your approximate family income? Check ONE.

- ☐ Less than \$20,000 / year ☐ \$60,000 to \$79,999 / year
☐ \$20,000 to \$39,999 / year ☐ \$80,000 to \$99,999 / year
☐ \$40,000 to \$59,999 / year ☐ More than \$100,000 / year

L. May we contact you if we have any questions? Check ONE.

- ☐ No ☐ Yes _____

Name _____
Phone _____
Best time to call _____

Please give us any comments on the back of this sheet. If you have questions, call Brian Kirking at ABAG at (510) 464-7996, or e-mail us at shaky@abag.ca.gov. Thank you for your time! Please mail this survey back to us.

Give us your comments here. In particular:

- ◆ give us any comments you may have about your answers, and
- ◆ give us any ideas on what cities and counties can do to encourage you to strengthen your home.

ATTACHMENT 2 –

The three postcards mailed during the course of the survey are included on this sheet. The first postcard, located to the right, was mailed to all survey participants who had not returned the survey by July 6, 1998.

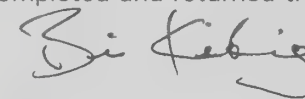
The Richmond and Napa postcards, included below, were mailed to all survey participants in those two cities who had not returned the survey by August 13, 1998.

ASSOCIATION OF BAY AREA GOVERNMENTS

Representing City and County Governments of the San Francisco Bay Area

Last month, you should have received a blue questionnaire asking about measures you have taken to prepare your home for future earthquakes. This card is a reminder that less than 1 in every 200 households received this questionnaire. Therefore, your response is very valuable in helping us design programs that will help our cities be better prepared. Your participation is important, ***whether or not you have done work on your home.***

If you did not receive a questionnaire, or if it has been misplaced, please call me at 510/464-7996, and I will get another one in the mail to you today. If you have already completed and returned the survey, please accept our thanks.

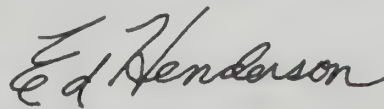


Brian Kirking
Association of Bay Area Governments (ABAG)
Earthquake Safety Survey
P. O. Box 2050
Oakland, CA 94604-2050

Recently you received an Earthquake Safety Survey from the Association of Bay Area Governments asking about measures you have taken to prepare your home for future earthquakes. The City of Napa hopes to use the information from this survey to help us improve the safety of our city. Therefore, if you have not already done so, please complete the survey and return it to ABAG. Your participation is important, ***whether or not you have done work on your home.***

Your answers are anonymous. The City will not receive your name or address, and we will not use this information for code enforcement. If you did not receive a questionnaire, or if it has been misplaced, please call ABAG at 510/464-7996, and they will be happy to mail you another.

City of Napa



Ed Henderson, Mayor
City of Napa

Recently you received an Earthquake Safety Survey from the Association of Bay Area Governments asking about measures you have taken to prepare your home for future earthquakes. The City of Richmond hopes to use the information from this survey to help us improve the safety of our city. Therefore, if you have not already done so, please complete the survey and return it to ABAG. Your participation is important, ***whether or not you have done work on your home.***

Your answers are anonymous. The City will not receive your name or address, and we will not use this information for code enforcement. If you did not receive a questionnaire, or if it has been misplaced, please call ABAG at 510/464-7996, and they will be happy to mail you another.



Rosemary Corbin, Mayor
City of Richmond

ATTACHMENT 3 –

July 29, 1998

Enclosed is a survey related to what you have done to better prepare yourselves and your property for future earthquakes. We originally sent this survey about a month ago to sample homeowners throughout the Bay Area, including yourself.

If you are one of the many people who completed the survey, we thank you for helping us with this important project, and you may disregard this letter.

We have not received as many completed surveys as anticipated, however, for homes in medium-size cities. We want to make sure that the needs of all areas – not just San Francisco, Oakland, and San Jose – are addressed in any program we design to encourage people to retrofit (through classes on how to retrofit your home yourself, financial incentives, hands-on help by city building departments, or in other ways). Therefore, as one of the few homeowners in these cities who has received this survey, your input is particularly important.

Please take a few minutes, fill out this questionnaire, and return it in the enclosed envelope. If you don't know the answer to a particular question, just note this on the survey and fill out as much of it as you can. If you have questions, please call us at 510/464-7996. Thank you for your time.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeanne Perkins". The signature is fluid and cursive, with the first name "Jeanne" being more prominent than the last name "Perkins".

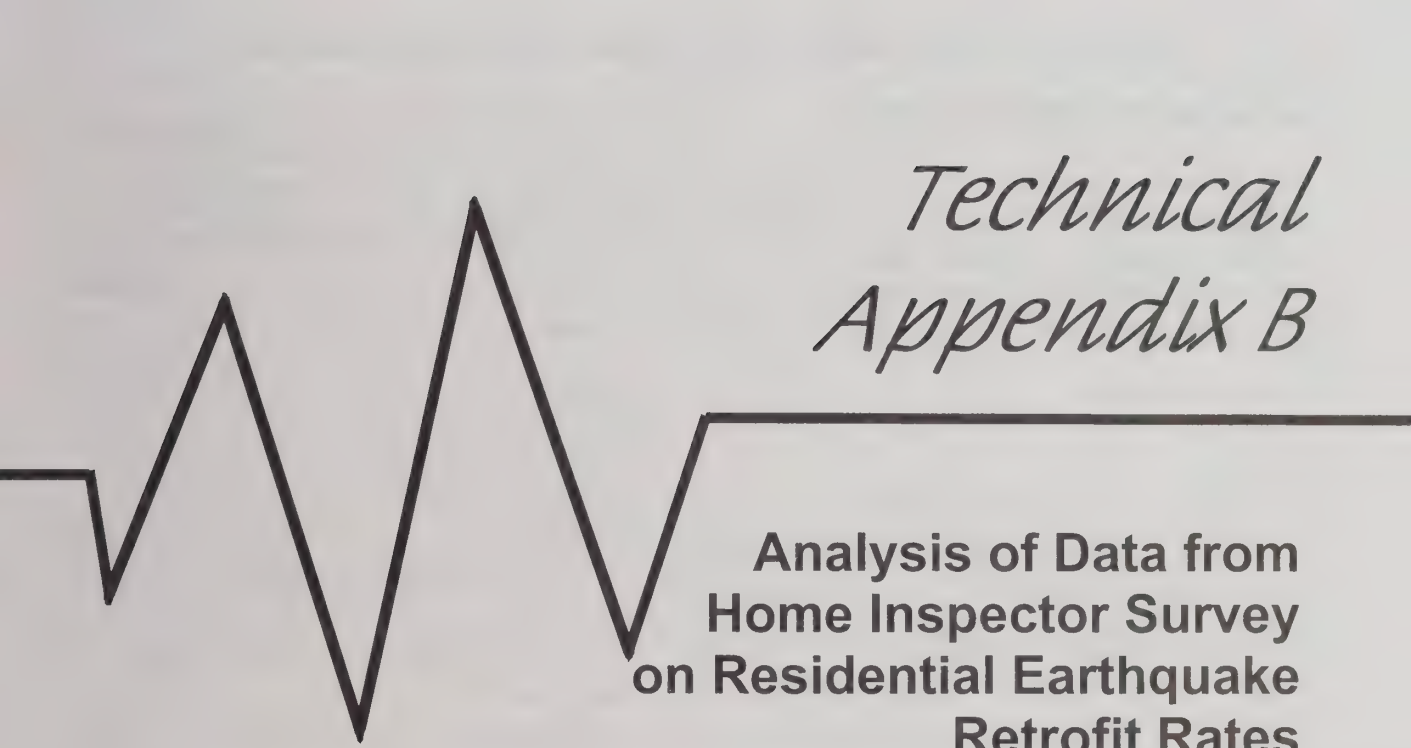
Jeanne Perkins
ABAG Earthquake Program Manager

Enclosed survey and return envelope



Technical Appendix B

Analysis of Data from Home Inspector Survey on Residential Earthquake Retrofit Rates



Technical Appendix B

Analysis of Data from Home Inspector Survey on Residential Earthquake Retrofit Rates

During six months in 1998, members of the American Society of Home Inspectors (ASHI) helped ABAG by collecting data on all homes they inspect for sale built prior to 1960, as well as on all apartments, regardless of age. The inspectors were asked to fill out a simple one-page form (a copy of which is on the following page).¹ The inspectors filled out a total of 341 usable surveys, which are described on the following pages.

The survey was used in several ways, including:

- ◆ to document skewing of results of the survey of single-family homeowners related to the percentage of homeowners that have retrofitted (see ABAG Analysis of Data from a Survey of Owners of Single-Family Homes – Technical Appendix A);
- ◆ to estimate, in conjunction with that homeowner survey, the percentage of homes that have been adequately retrofitted, as well as those that have had some retrofit work performed on them;
- ◆ to estimate the extent to which homes are being improperly, or inadequately, retrofitted; and
- ◆ to serve as one source of information on retrofitting of multifamily (versus single-family) homes.

Although the survey of single-family homeowners indicated that some retrofit work has occurred on over three-fourths of the older homes in the urban East Bay, this ASHI survey documents skewing and estimates these numbers are high. Still, approximately half of the older homes probably have had some retrofit work, a number much higher than we might have estimated without this information. However, only a third-to-half of these homes with some retrofit work have had reasonably adequate work. Retrofit rates for small multifamily residential buildings in Berkeley approach that of single-family homes, while the retrofit rates in Oakland for multifamily buildings are much lower.

¹ ASHI members did not charge for this service, but requested that ABAG help organize a special training class for their members. The class was held on Saturday, February 20, 1999.

FIGURE B1: ABAG Residential Earthquake Safety Information Form

BACKGROUND INFORMATION

City _____

Address _____

*(round address to nearest 100 – that is,
844 Oak St. would become 800 Oak St.)*

Inspection Date _____

Owner Occupied?

☐ Yes

☐ No

☐ Don't know or not available

GENERAL QUESTIONS

1. Number of above-grade stories _____
*(fill in number, including above-grade parking)
(split-level = 1½)*

2. Number of housing units _____

3. Approximate square footage _____

4. Ground floor use *(check all that apply)*

☐ Residential

☐ Commercial

☐ Parking

5. Decade of original construction _____
(that is, 1950s, etc.)

6. Has the water heater been braced to resist lateral movement?

☐ Yes

 ▶ Number of straps _____

☐ No

7. Have the chimneys been braced?

☐ Yes, all

☐ Yes, some of them

☐ Not braced

☐ No chimney

8. Above-grade construction is primarily –

☐ Wood frame *(continue with next column)*

☐ Other frame or wall type
(concrete, steel, masonry) (STOP HERE)

WOOD-FRAME HOUSING DATA

1. Was there a significant addition to this building after its original construction?

☐ Yes *(use this column for the addition)*

☐ No

2. Is there a crawl space?

☐ Yes, more than 48"

☐

☐ Yes, less than 48"

☐

☐ No or inaccessible

☐

3. Foundation material

☐ Brick

☐

☐ Concrete (poured or block)

☐

☐ Other

☐

4. Are there bolts attaching the frame to the foundation?

☐ Yes

☐

 ▶ Are there washers?

☐ Square

☐

☐ Round

☐

☐ None

☐

☐ No

☐

☐ Hidden or unknown

☐

5. In the crawl space or parking area, is there plywood sheathing to resist lateral movement on the *inside* face of the cripple wall?

☐ Yes, some on all walls

☐

☐ Yes, but only on 1 or 2 walls

☐

☐ No

☐

☐ No cripple wall or inaccessible

☐

6. Was the building retrofitted with a steel frame around the parking/garage door opening?

☐ Yes

☐ No

7. Did you observe damage or deterioration that is likely to affect the performance of this building in an earthquake?

☐ Yes

☐ No

8. Was there a referral to a licensed professional due to structural or foundation concerns?

☐ Yes

☐ No

COMMENTS:

Survey Data

As shown in the following table, participation was excellent among inspection companies in the urban East Bay, particularly for Alameda, Oakland and Berkeley. However, few surveys were completed for homes in the remaining communities which were targeted for the homeowner survey. As of January 21, 1999, 341 surveys had been entered into a database for analysis. Of the 341 surveys,

- ◆ 138 surveys had been returned for Oakland,
- ◆ 78 surveys had been returned for Berkeley,
- ◆ 41 surveys had been returned for Alameda,
- ◆ 16 surveys had been returned for San Leandro,
- ◆ 15 surveys had been returned for all other cities that had received ABAG's homeowner survey, with no more than 10 surveys from any single city, and
- ◆ 53 surveys had been returned for all other cities that had *not* received ABAG's homeowner survey.

TABLE B1: Data Obtained by ASHI Inspectors by Jurisdiction

Jurisdictions Included in Homeowner Survey			Jurisdictions Not Included in Homeowner Survey		
<i>Jurisdiction</i>	<i>#of Responses</i>	<i>% of Total</i>	<i>Jurisdiction</i>	<i>#of Responses</i>	<i>% of Total</i>
Oakland	138	40.5%	El Cerrito	16	4.7%
Berkeley	78	22.9%	Albany	9	2.6%
Alameda	41	12.0%	Piedmont	9	2.6%
San Leandro	16	4.7%	Kensington	5	1.5%
Richmond	7	2.1%	Castro Valley	3	0.9%
Concord	4	1.2%	Moraga	2	0.6%
San Francisco	3	0.9%	San Pablo	2	0.6%
San Jose	1	0.3%	Fairfax	1	0.3%
<i>Total in Survey Cities</i>	<i>288</i>	<i>84.5%</i>	Hayward	1	0.3%
			Lafayette	1	0.3%
			Los Altos	1	0.3%
			Pleasant Hill	1	0.3%
			San Anselmo	1	0.3%
			(Blank)	1	0.3%
			<i>Total in Non-Survey Cities</i>	<i>53</i>	<i>15.5%</i>

Responses to Individual Questions

Table B2 on the following three pages summarizes the results for individual questions.

TABLE B2: Responses to ASHI Survey Questions

[Note: Values in "total" column include cities other than the four listed;
percentages may not add to 100% due to rounding errors.]

Owner occupied?									
Response	Oakland		Berkeley		Alameda		San Leandro		Total
Yes	83	61.0%	48	62.3%	24	60.0%	9	56.3%	203 60.2%
No	52	38.2%	28	36.4%	16	40.0%	5	31.3%	130 38.6%
Don't know	1	0.7%	1	1.3%	0	0.0%	2	12.5%	4 1.2%
Total	136		77		40		16		337
1. Number of above-grade stories									
Response	Oakland		Berkeley		Alameda		San Leandro		Total
1(includes 1.5)	56	38.9%	36	42.4%	21	42.0%	14	58.3%	168 49.4%
2 (includes 2.5)	63	43.8%	33	38.8%	22	44.0%	2	8.3%	133 39.1%
3+	25	17.4%	16	18.8%	7	14.0%	8	33.3%	39 11.5%
Total	144		85		50		24		340
2. Number of housing units									
Response	Oakland		Berkeley		Alameda		San Leandro		Total
1	118	85.5%	58	75.3%	36	87.8%	13	81.3%	287 84.4%
2-3	12	8.7%	14	18.2%	5	12.2%	1	6.3%	35 10.3%
4+	8	5.8%	5	6.5%	0	0.0%	2	12.5%	18 5.3%
Total	138		77		41		16		340
3. Approximate square footage									
Response	Oakland		Berkeley		Alameda		San Leandro		Total
<1000	5	3.7%	6	7.8%	1	2.4%	0	0.0%	287 76.9%
1000-1999	78	57.4%	42	54.5%	28	68.3%	13	81.3%	35 9.4%
2000-2999	36	26.5%	18	23.4%	11	26.8%	1	6.3%	18 4.8%
3000+	17	12.5%	11	14.3%	1	2.4%	2	12.5%	33 8.8%
Total	136		77		41		16		373
4. Ground floor use (check all that apply)									
Response	Oakland		Berkeley		Alameda		San Leandro		Total
Residential	123	89.1%	66	85.7%	41	100.0%	15	93.8%	308 90.6%
Commercial	1	0.7%	2	2.6%	0	0.0%	0	0.0%	3 0.9%
Parking	47	34.1%	15	19.5%	17	41.5%	2	12.5%	113 33.2%
Total buildings	138		77		41		16		340
NOTE: Some buildings had more than one ground floor use.									
5. Decade of original construction									
Response	Oakland		Berkeley		Alameda		San Leandro		Total
<1920	21	15.2%	20	25.6%	10	24.4%	0	0.0%	54 15.8%
1920-1939	50	36.2%	38	48.7%	13	31.7%	5	31.3%	122 35.8%
1940-1960	40	29.0%	18	23.1%	6	14.6%	10	62.5%	107 31.4%
1960+	27	19.6%	2	2.6%	12	29.3%	1	6.3%	58 17.0%
Total	138		78		41		16		341

TABLE B2: Responses to ASHI Survey Questions (continued)

6. Has the water heater been braced to resist lateral movement?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes	85	62.5%	46	59.7%	25	61.0%	7	46.7%	209	62.0%
No	51	37.5%	31	40.3%	16	39.0%	8	53.3%	128	38.0%
Total	136		77		41		15		337	

If yes, # of straps

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
1	21	26.9%	16	40.0%	13	54.2%	4	80.0%	72	37.9%
2+	57	73.1%	24	60.0%	11	45.8%	1	20.0%	118	62.1%
Total	78		40		24		5		190	

7. Have all the chimneys been braced?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes, all	13	9.6%	7	9.6%	2	4.9%	0	0.0%	31	9.3%
Yes, some of them	0	0.0%	0	0.0%	1	2.4%	0	0.0%	1	0.3%
Not braced	94	69.6%	53	72.6%	32	78.0%	12	75.0%	238	71.7%
No chimney	28	20.7%	13	17.8%	6	14.6%	4	25.0%	62	18.7%
Total	135		73		41		16		332	

8. Above-grade construction is primarily--

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Wood frame	138	97.9%	76	100.0%	40	100.0%	16	100.0%	334	98.8%
Other frame or wall type	3	2.1%	0	0.0%	0	0.0%	0	0.0%	4	1.2%
Total	141		76		40		16		338	

Wood-Frame Housing Data

1. Was there a significant addition to this building after its original construction?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes	47	34.6%	27	34.6%	20	50.0%	6	37.5%	126	37.4%
No	89	65.4%	51	65.4%	20	50.0%	10	62.5%	211	62.6%
Total	136		78		40		16		337	

2. Is there a crawl space?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes, more than 48"	45	33.3%	20	25.6%	6	20.0%	0	0.0%	87	26.0%
Yes, less than 48"	75	55.6%	53	67.9%	21	70.0%	14	87.5%	202	60.3%
No or inaccessible	15	11.1%	5	6.4%	3	10.0%	2	12.5%	46	13.7%
Total	135		78		30		16		335	

3. Foundation material

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Brick	4	2.9%	5	6.5%	5	12.5%	0	0.0%	14	4.2%
Concrete (poured or block)	132	97.1%	72	93.5%	35	87.5%	16	100.0%	321	95.8%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	136		77		40		16		335	

TABLE B2: Responses to ASHI Survey Questions (continued)

4. Are there bolts attaching the frame to the foundation?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes	95	70.4%	55	73.3%	21	53.8%	11	73.3%	237	71.8%
No	33	24.4%	15	20.0%	12	30.8%	2	13.3%	68	20.6%
Hidden or unknown	7	5.2%	5	6.7%	6	15.4%	2	13.3%	25	7.6%
Total	135		75		39		15		330	

If yes, are there washers?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Square	1	1.3%	1	2.1%	0	0.0%	0	0.0%	3	1.5%
Round	69	87.3%	47	97.9%	17	94.4%	9	90.0%	189	91.7%
None	9	11.4%	0	0.0%	1	5.6%	1	10.0%	14	6.8%
Total	79		48		18		10		206	

5. In the crawl space or parking area, is there plywood sheathing to resist lateral movement on the inside face of the cripple wall?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes, some on all walls	28	20.7%	28	37.3%	5	12.5%	0	0.0%	74	22.3%
Yes, but only on 1 or 2 walls	11	8.1%	12	16.0%	0	0.0%	1	6.3%	28	8.4%
No	83	61.5%	30	40.0%	19	47.5%	10	62.5%	172	51.8%
No cripple wall or inaccessible	13	9.6%	5	6.7%	16	40.0%	5	31.3%	58	17.5%
Total	135		75		40		16		332	

6. Was the building retrofitted with a steel frame around the parking/garage door opening?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes	2	1.7%	2	3.2%	0	0.0%	0	0.0%	4	1.4%
No	117	98.3%	61	96.8%	32	100.0%	13	100.0%	281	98.6%
Total	119		63		32		13		285	

7. Did you observe damage or deterioration that is likely to affect the performance of this building in an earthquake?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes	35	25.7%	21	27.6%	10	24.4%	4	25.0%	81	24.1%
No	101	74.3%	55	72.4%	31	75.6%	12	75.0%	255	75.9%
Total	136		76		41		16		336	

8. Was there a referral to a licensed professional due to structural or foundation concerns?

Response	Oakland		Berkeley		Alameda		San Leandro		Total	
Yes	48	35.6%	28	37.3%	10	25.0%	6	37.5%	103	31.0%
No	87	64.4%	47	62.7%	30	75.0%	10	62.5%	229	69.0%
Total	135		75		40		16		332	

Data on Retrofit Rates for Single-Family Homes

When looking at the retrofit rates for single-family homes built prior to 1960 with the presence or absence of visible retrofit work, the number of usable surveys drops from 341 to 208. The two jurisdictions with large enough samples to be used for even somewhat *statistically significant* analyses are Oakland and Berkeley. However, we have also tabulated data for Alameda and San Leandro to see if *basic trends* continue to hold.

As with the homeowner survey, we defined a home as having had some retrofit work if the home was built prior to 1950 and had bolts, or was built prior to 1960 and had plywood on cripple walls. As can be seen from Table B3.1, below, there is a significant difference between the percentage of homes identified as having some retrofit work in the ASHI survey versus the ABAG homeowner survey. One explanation for part of the difference is if one assumes that people who had included seismic strengthening as part of an addition told us that they had retrofitted, even if they had not upgraded the original portion of their home, as shown in the middle column of Table B3.1, below. We are inclined to assume this to be the case. If one narrows the definition of retrofit to include only homes with plywood in the crawlspace, the retrofit rate drops further, as shown in Table B3.2, below. The percentages from the ASHI survey are consistently lower than in the homeowner survey.

**TABLE B3: A Comparison of Rates of Retrofit Work (Partial or Adequate)
in Selected Urban East Bay Cities**

Table B3.1: Some Retrofit Work

City	ASHI Inspection Survey Partial Retrofit Rate (not incl. Additions)	ASHI Inspection Survey Partial Retrofit Rate (incl. additions)	ABAG Homeowner Survey Partial Retrofit Rate
Berkeley	79 % (42 / 53)	83 % (44 / 53)	82.8% (149 / 180)
Oakland	44 % (36 / 81)	48 % (39 / 81)	75.0% (108 / 144)
Alameda	52 % (11 / 21)	67 % (14 / 21)	78.8% (93 / 118)
San Leandro	46 % (6 / 13)	46 % (6 / 13)	52.8% (57 / 108)

Table B3.2: Reasonably Adequate Retrofit Work

City	ASHI Inspection Survey Retrofit Rate (not incl. additions; must include bolts and, if crawlspace, plywood on ALL walls)	ASHI Inspection Survey Retrofit Rate (not incl. additions; may include plywood on only one wall if crawlspace)	ABAG Homeowner Survey Reasonably Adequate Retrofit Rate (must include bolts, and, if crawlspace, plywood)
Berkeley	38 % (20 / 53)	55 % (29 / 53)	62.8% (113 / 180)
Oakland	17 % (14 / 81)	25 % (20 / 81)	51.4% (74 / 144)
Alameda	19 % (4 / 21)	19 % (4 / 21)	45.8% (54 / 118)
San Leandro	31 % (4 / 13)	31 % (4 / 13)	20.4% (22 / 108)

There is the possibility of distorted responses, or *skewing*, in both surveys. The ABAG survey has the potential of distortion due to a tendency of those who have not retrofitted to not reply to

the survey. (The response rate for Berkeley was 41% and for Oakland was 27%.) Distortion is also possible in the ASHI survey if homes currently for sale tend to have been sold more recently than homes in general. Thus, to the extent that Berkeley's program targets retrofitting homes during the sale process, the retrofit rate in Berkeley may be slightly exaggerated. However, skewing of the ASHI survey data should be significantly lower than for the homeowner survey.

However, in spite of all of these sources of error, it is reasonable to assume that half of the homes in the urban east Bay have had some retrofit work! This number is far higher than anticipated prior to the start of this work.

Finally, one can calculate a "follow-through" rate, the ratio of homes with reasonably adequate work (first column of Table B3.2) to those that had some retrofit work done (middle column of Table B3.1). ***Homes in the cities of Berkeley and San Leandro had higher percentages of "follow through"*** (45% and 67%) than in Oakland (36%) or Alameda (29%). We calculated this follow-through rate using data from the homeowner survey as a comparison to see if the trend can be seen in that larger database. In this case, the percentages for Berkeley (76%), Oakland (69%), Alameda (58%) are far higher than in the ASHI database. They reflect the skewing of the data toward people who had done work, and the general trend of overstating the amount of work that had occurred. San Leandro's (39%) is lower than in the ASHI survey, but the ASHI survey data is based on so few surveys that it is not particularly significant.

Estimation of "Actual" Retrofit Rates for Single-Family Homes

Assuming that the ASHI survey data are reasonably accurate for the cities of Berkeley and Oakland, it is possible to develop a formula to correct the skewing of the homeowner survey data. That formula can then be used to estimate the "actual" (or un-skewed) retrofit rate for the other communities whose homeowners were surveyed. This formula uses data on retrofit rates from both surveys for these two cities, as well as the response rate for the homeowner survey.

TABLE B4: Key Single-Family Survey Data for Oakland and Berkeley

Table B4.1: Some Retrofit Work

City	ASHI Inspection Survey Partial Retrofit Rate (including additions)	ABAG Homeowner Survey Partial Retrofit Rate	ABAG Homeowner Survey Response Rate
Berkeley	83 %	82.8 %	41%
Oakland	48 %	75.0 %	27%

Table B4.2: Reasonably Adequate Retrofit Work

City	ASHI Inspection Survey Retrofit Rate (not including additions; plywood on all walls if crawl space)	ABAG Homeowner Survey Reasonably Adequate Retrofit Rate (must include bolts, and, if crawl space, plywood)	ABAG Homeowner Survey Response Rate
Berkeley	38 %	62.8%	41%
Oakland	17 %	51.4 %	27%

TABLE B5: Predicted “Actual” Retrofit Rate for Targeted Cities**Table B5.1: Some Retrofit Work**

City	ASHI Inspection Survey Retrofit Rate (in %)	ABAG Homeowner Survey Retrofit Rate (in %)	ABAG Homeowner Survey Response Rate (in %)	ABAG Predicted “Actual” Retrofit Rate (in %)
Oakland	48	75.0	27.0	48
Berkeley	83	82.8	40.8	83
Alameda	67	78.8	28.4	53
San Leandro	46	52.8	23.6	31
San Francisco	Not available	73.6	23.1	42
Daly City	Not available	42.1	28.7	28
Palo Alto	Not available	62.3	35.6	52
Los Gatos	Not available	82.2	32.4	62
Santa Clara	Not available	29.2	21.0	16
San Jose	Not available	57.2	27.4	37
Richmond	Not available	58.4	24.7	35
Concord	Not available	28.7	25.2	17
Napa	Not available	39.7	22.0	22
Santa Rosa	Not available	56.4	29.6	39
Lexington Hills	Not available	56.7	27.0	36
San Lorenzo	Not available	38.1	23.6	22
Crockett	Not available	53.1	32.7	40

Table B5.2: Reasonably Adequate Retrofit Work

City	ASHI Inspection Survey Retrofit Rate	ABAG Homeowner Survey Retrofit Rate	ABAG Homeowner Survey Response Rate	ABAG Predicted “Actual” Retrofit Rate
Oakland	17	51.4	27.0	17
Berkeley	38	62.8	40.8	37
Alameda	19	45.8	28.4	16
San Leandro	31	20.4	23.6	6
San Francisco	Not available	50.3	23.1	14
Daly City	Not available	23.4	28.7	8
Palo Alto	Not available	36.4	35.6	17
Los Gatos	Not available	48.9	32.4	20
Santa Clara	Not available	12.3	21.0	3
San Jose	Not available	18.4	27.4	6
Richmond	Not available	17.8	24.7	5
Concord	Not available	24.1	25.2	7
Napa	Not available	12.8	22.0	3
Santa Rosa	Not available	15.5	29.6	6
Lexington Hills	Not available	23.3	27.0	8
San Lorenzo	Not available	16.7	23.6	5
Crockett	Not available	37.5	32.7	15

Notes on Development of Formula to Estimate “Actual” Retrofit Rates for Single-Family Homes –

Initially, we calculated the simple ratios between the homeowner survey retrofit rates and the ASHI survey retrofit rates. These ratios (1.0 for Berkeley and 1.6 for Oakland for partial retrofits, for example) are quite different.

Our second attempt was slightly more complex. We used the ASHI data to calculate the retrofit rate for those homeowners who had not completed the survey. This nonrespondent retrofit rate (HSNRR) can be calculated as:

$$(RR \times HSRR) + (1 - RR) \times (HSNRR) = ARR$$

where:

RR = Homeowner Survey Response Rate

HSRR = Homeowner Survey Retrofit Rate

HSNRR = Homeowner Survey Nonrespondent
Retrofit Rate

ARR = ASHI Retrofit Rate

The nonrespondent retrofit rate for partial retrofits for Berkeley is 78.6%, and for Oakland is 36.6%. Again, these numbers are quite different.

We then calculated the ratio between the nonrespondent and respondent retrofit rates as 1.09 for Berkeley and 2.05 for Oakland. Again, these ratios were quite different and pointed to a more complex relationship.

Next, we assumed that we could define a base retrofit rate which could be added to the nonrespondent value to create a workable formula. Again, these efforts failed.

These calculations were followed by a series of calculations trying to use the differences between the respondents' answers to questions about income and education with census data and data from the homeowner survey about the influence of income and education on retrofit to create a much more complex formula. None of these calculations proved simple or informative.

Our best effort at developing a formula assumes that the homeowner survey response rate can be used to create a formula, $R + K \times (RR)$, where:

R = Base retrofit ratio

K = Importance factor for the response rate

RR = Response rate

This ratio can be used to calculate the retrofit rate for unanswered surveys. That nonrespondent retrofit rate can then be used to calculate the estimated “actual” retrofit rate. The estimated “actual” retrofit rates for the surveyed communities are contained in Table B5, based on:

for some retrofit work – $R=3.86$ and $K=7.0$

for reasonably adequate work – $R=29.4$ and $K=64.3$

Comparison of Retrofit Rates of Single-Family Homes Versus Multifamily Homes and Mobile Homes

Very little actual information exists on retrofit rates of mobile homes and multifamily apartments or condominiums. The following three sources summarize the existing information.

ASHI Inspection Survey Data

The ASHI survey collected some data on 53 small multifamily buildings containing 745 units, including 19 buildings with 63 units in Berkeley and 20 buildings with 176 units in Oakland. However, the survey data on 3 buildings containing 8 units in Berkeley and 4 buildings containing 126 units in Oakland was incomplete. Data on the remaining buildings was used to estimate the partial and “adequate” retrofit rates for these buildings and units and to compare it with the retrofit rate for single-family homes, as shown in Tables B6 and B7. The survey data can be analyzed for all multifamily buildings in these two cities, or limited to those buildings constructed prior to 1960. (Limiting the analysis to buildings constructed prior to 1960 further limits the data to 17 buildings with 47 units in Berkeley, and 13 buildings with 44 units in Oakland.) The definition of partial retrofit was the same as for single-family homes, but the definition of adequate retrofit was modified. Multifamily buildings with ground-floor parking

and with living units above that parking had to have some strengthening of the garage opening to be considered adequately retrofitted.

TABLE B6: Key Multifamily ASHI Inspection Survey Data for Oakland and Berkeley

TABLE B6.1 Data for ALL Multifamily Buildings

City	Fraction at Least Partially Retrofitted		Partial Retrofit Rate for Multifamily Housing		Fraction Adequately Retrofitted		Adequate Retrofit Rate for Multifamily Housing	
	Buildings	Units	Buildings	Units	Buildings	Units	Buildings	Units
Berkeley	11/16	43/55	69%	78%	6/16	18/55	38%	33%
Oakland	2/16	16/50	12%	32%	0/16	0/50	0 %	0 %

TABLE B6.2 Data for Multifamily Buildings Built Prior to 1960

City	Fraction at Least Partially Retrofitted Built Pre-1960		Partial Retrofit Rate for Pre-1960 Multi-family Housing		Fraction “Adequately” Retrofitted Built Pre-1960		“Adequate” Retrofit Rate for Pre-1960 Multi-family Housing	
	Buildings	Units	Buildings	Units	Buildings	Units	Buildings	Units
Berkeley	10/14	29/39	71%	74%	6/14	18/39	43%	46%
Oakland	2/12	16/40	17%	40%	0/12	0/40	0 %	0 %

It is interesting that the ratio of retrofit rates for multifamily versus single-family construction is very different for these two cities, as shown in Table B7, below. Unfortunately, these data are for so few buildings and units that they are not statistically valid in documenting a high retrofit rate for small multifamily residential buildings in Berkeley. However, the general conclusion that retrofit rates for multifamily housing is less than for single-family homes is valid.

TABLE B7: Single-Family Vs. Multifamily ASHI Survey Data for Oakland and Berkeley

Table B7.1: Some Retrofit Work

City	Single-Family Retrofit Rates (Some Retrofit Work)	Multifamily Building Retrofit Rates (Some Retrofit Work)	Ratio of Retrofit Rates (Multifamily / Single)
Berkeley	83 %	69 %	0.8
Oakland	48 %	12 %	0.3

Table B7.1: Reasonably Adequate Retrofit Work

City	Single-Family Retrofit Rates (Reasonably Adequate Work)	Multifamily Building Retrofit Rates (Reasonably Adequate Work)	Ratio of Retrofit Rates (Multifamily / Single)
Berkeley	38 %	33 %	0.9
Oakland	17 %	0 %	0

ABAG Homeowner Survey Data

As discussed earlier, ABAG surveyed single-family homeowners in 17 communities. One question on that survey is particularly relevant to this discussion - whether or not the owner currently lived in or rented out the home. Interestingly, the rate of performing some retrofit among owner-occupants responding to the survey was 63.0% versus 41.0% for those renting out the home; the rate of reasonably adequate retrofit was 35.7% versus 21.4% for those renting out the home. The issue of ownership may therefore be partially responsible for a discrepancy between single-family and multifamily retrofit rates apparent from the ASHI data.

Given the relative lack of data from other sources, we decided to conduct a survey of multifamily residential buildings in Berkeley and Oakland during the summer of 1999. (See Technical Appendix D for further information on this survey.) As with the single-family homeowners survey, the retrofit information is highly skewed. (In spite of the small amount of data obtained from the ASHI survey, it is potentially more accurate.) However, two relationships from that survey are highly relevant to this discussion. First, the retrofit rate for 2-4 unit buildings is far higher than for 5 or more unit buildings in Berkeley, pointing to a potentially large impact of Berkeley's property transfer tax rebate program (described briefly below). Second, the retrofit rate for 2-4 unit buildings may be higher than for single-family homes in Berkeley, pointing to a greater impact of that program on investment properties than on homes with owner-occupants.

Data from the City of Berkeley Financial Incentive Program

A 1992 City of Berkeley ordinance waives permit fees paid to the city for seismic retrofits on non-strengthened single-family residences, multifamily residential buildings of up to four dwelling units, and unreinforced masonry structures. ***Since 1996, when detailed data have been collected for these projects, 1,239 were for single-family homes, but 324 were for multifamily projects.*** Given that there are approximately the same number of single-family units and multifamily units (not buildings) in the City, these data would seem to confirm that the high retrofit rate for multifamily buildings in Berkeley is "real." The financial incentive program may be responsible for triggering these retrofits. (See Technical Appendix C for further information on this program.)

Santa Cruz County Brace for the Quake Program Data

The final source of retrofit information is data collected by FEMA in monitoring Santa Cruz County's ***Brace for the Quake*** program.

The retrofit program provided grants to 412 single-family homes. Although any home built prior to 1980 might be considered a candidate for the program, it was targeted to pre-World War II units. The data suggest that several 1950s vintage homes were among the homes retrofitted. Thus, it seems reasonable to assume that the "universe" of homeowners which might apply for funding was the number of single-family homes built prior to 1960. However, the universe of multifamily units and mobile homes did not have a specific age-related cutoff. 1990 Census data can therefore be used to estimate the number of units available for retrofit, and the increase in retrofitting that can be attributed to this program.

TABLE B8: Santa Cruz County *Brace for the Quake* Program Data

City	Number of Units in County	Number of Units Retrofitted	Retrofit Rates
Single-Family	20,578	412	2.0%
Multifamily	17,554	331	1.9%
Mobile Homes	7,157	451	6.3%

Again, this information seems to suggest that the retrofit rates for single-family versus multifamily units can be similar given financial incentives. Another possible explanation for this similarity is that these numbers represent increases in retrofitting from 1992 until 1996. To the extent that many single-family homes might have been retrofitted prior to 1992, the actually number of unretrofitted single-family homes needing retrofit may have been smaller.

The retrofit rate for mobile homes is the highest for the three types of buildings. According to FEMA, there was almost no outreach on the program by the County, except for facilitating a few newspaper stories. The mobile home success rate was almost entirely due to outreach by the contractors. One contractor, in particular, did most of the mobile homes. Fortunately, both the County and FEMA were pleased with this contractor, for they did high quality work. They also had good marketing and convinced people to sign up. All installations were independently inspected – which, for the mobile homes, was usually a State inspector. As with the multifamily retrofit rates, it is likely that one of the reasons for the high incremental increase in retrofitting of mobile homes may have been the relatively low retrofit rate prior to the onset of the program. (See Technical Appendix C for further information on this program.)



Technical Appendix C

Existing Government
Financial Incentive
Programs
for Earthquake Retrofit

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Technical Appendix C

Existing Government Financial Incentive Programs for Earthquake Retrofit

There are a variety of local, state and federally-funded government programs which have provided, or are continuing to provide, financial incentives for owners of single family homes, mobile homes, or apartments to structurally retrofit those buildings.

The principal local government programs are:

- ◆ Santa Cruz County – Brace for the Quake Program
- ◆ City of Los Angeles – Seismic Mitigation Loan Program
- ◆ City of Oakland – Project SAFE
- ◆ City of Berkeley – Seismic Retrofitting Incentive Program
- ◆ Association of Bay Area Governments (ABAG) Finance Authority for Nonprofit Corporations – Affordable Housing Program

In addition, there are three programs offered covering several counties in California:

- ◆ California Earthquake Authority – Residential Retrofit Program
- ◆ California Department of Insurance – Loan Program
- ◆ California Department of Insurance – Grant Program

Santa Cruz County – Brace for the Quake Program

From 1992 until October 1996, Santa Cruz County reimbursed homeowners for half the cost of residential seismic retrofits, up to a maximum grant per unit of \$10,000. Funds for the program came from the Federal Emergency Management Agency's Hazard Mitigation Grant Program. Funds from this program were made available as a result of the 1989 Loma Prieta earthquake.

A total of 979 retrofit applications were approved, while 894 of those have been completed:

- ◆ 412 single family homes,
- ◆ 451 mobile homes, and
- ◆ 31 multi-unit buildings (representing a total of 331 units).

The program started in mid-1992, almost three years after the October 1989 Loma Prieta earthquake. However, the program allowed retroactive funding. Approximately one-third of the applications were for work already completed before the program came into effect.

(Description based on written communication from Leo Levinson, FEMA, February 4, 1998)

City of Los Angeles – Seismic Mitigation Loan Program

In February 1998, the City of Los Angeles Housing Department began working with Bank of America to subsidize interest rates for retrofits. The program uses federal Community Development Block Grant funds to “buy down” interest rates by approximately 1%.

Although the City has mailed out hundreds of applications mailed to homeowners requesting them, *only 12 have been returned for funding as of January 1999*. This 2% return rate is in spite of what the City views as a “user friendly” program offering a loan approval turn-around of about 10 days.

To increase awareness of the program, the City has created a video for TV cable access channels, and is in the process of mailing out 160,000 information brochures to owners of single-family homes built prior to 1940. They hope for a 2% return rate, which would mean 3,200 loan applications.

(Description based on oral communication from David Fleischman, City of Los Angeles Housing Department, Special Finance Unit, January 11, 1999)

City of Oakland – Project SAFE

In January 1998, the City of Oakland initiated Project SAFE (Safety and Future Empowerment). This project is a FEMA Project Impact pilot project and a collaboration between Oakland residents, business owners, and government agencies designed to reduce losses in life and property caused by natural disasters (including earthquakes, fire, and severe weather). The hazard reduction will be accomplished by providing incentives such as grants and low interest loans to eligible homeowners or businesses who agree to use the funds to make their property more resistant to natural disasters.

Homeowners may qualify for grants or low interest loans to:

- ◆ strap water heaters
- ◆ upgrade security bar releases
- ◆ upgrade downspouts, gutters and drains
- ◆ install smoke detectors
- ◆ bolt foundations
- ◆ install plywood for cripple wall bracing

Apartment building owners may qualify for low interest loans to:

- ◆ strap hot water heaters
- ◆ upgrade down spouts and drainage

- ◆ build retaining walls
- ◆ install seismic retrofit work

Businesses may qualify for low interest loans to pay for seismic retrofitting, earthquake kits, eligible equipment enhancements, and additional employee training. Small businesses may qualify for special program rebates, discounts and incentives.

In 1998, 27 citizens of Oakland filled out applications and submitted the required documents. Of those 27, 13 homeowners met the low income criteria, and are therefore eligible for grants. The 13 are currently going through acquiring 3 bids. The remaining 14 are eligible to obtain lower interest loans and have been referred to Project SAFE financial institution partners (Washington Mutual and Bank of America). Sierra West Bank and Bank of America are early financial partners for any loans to businesses; they work with SBA loans. Other financial institutions are expected to become partners in the future. Finally, Project SAFE has completed nonstructural mitigation (safety latches on overhead cupboards, strapping of water heaters, strapping of large appliances and heavy furniture, smoke detectors, and education) in the residences of 225 at-risk citizens (low income, seniors and disabled) at no cost to the resident. Many Project SAFE partners have made these accomplishments a reality. The program is on-going.

(Description based on written communication from Colleen Bell and Henry Renteria, City of Oakland, February 22, 1999)

City of Berkeley – Seismic Retrofitting Incentive Program

This incentive program is a joint effort under the departments of Planning, Housing, and Finance. It provides two economic incentives to homeowners.

First, a local ordinance waives permit fees paid to the city for seismic retrofits on non-strengthened single-family residences, multi-family residential buildings of up to four dwelling units, and unreinforced masonry structures. As shown in Table 1, below, *between 1992 and February 1999, 4,088 projects representing \$1,078,215 in permit fees were approved without fee payment. This amount represents an overall average of \$264 per project, but approximately \$400 per project in recent years. Of the 2,088 projects since late 1996, 1,619 were for single-family homes and 469 for multi-family projects.* The projects are fairly well distributed throughout the City. Thus, this incentive has helped low-income homeowners, and may have increased the degree to which middle- and upper-income homeowners have retrofitted. This program is on-going.

TABLE C1 – Data on City of Berkeley Program to Waive Permit Fees

Calendar Year	Permit Fees Waived		
	Amount	# Permits	Ave. / Property
1/92-8/96	\$229,000	2,000	\$115
9/96-12/96	\$269,059	670	\$402
1997	\$272,649	637	\$428
1998	\$267,841	684	\$392
1/99-2/99	\$39,666	97	\$409
	\$1,078,215	4,088	\$264

Second, the city has a 1.5% tax levied on property transfer transactions; up to one-third of this amount can be applied for seismic upgrades during the sale of property. Qualifying upgrades include foundation repair or replacement, mudsill repair or replacement, wall bracing in basements, foundation-to-mudsill bolting, shear wall installation, water heater anchoring, and securing of chimneys. As shown in Table 2, below, from FY 92-93 to FY 97-98, **this program returned a total of \$3,589,399 to 7,641 property owners to help pay an average of \$470 for retrofit on their properties.** (This amount also represents lost revenue for the city.) The program is also ongoing.

TABLE C2 – Data on City of Berkeley Program to Rebate One-Third of Property Transfer Tax

Fiscal Year	Property Taxes Rebated		
	Amount	# Properties	Ave. / Property
92-93,93-94	\$900,000	1,300	\$692
93-94	\$526,476	1,143	\$461
94-95	\$560,964	1,195	\$469
95-96	\$557,235	1,261	\$442
96-97	\$460,265	1,287	\$358
97-98	\$584,459	1,455	\$402
	\$3,589,399	7,641	\$470

(Description based on written and oral communications from Arrieta Chakos, City Manager's Office, and Joe Koontz, Planning and Development Dept, February - March, 1999)

California Earthquake Authority – Residential Retrofit Program

The California Earthquake Authority is a quasi-public agency regulated as a private insurer by the California Department of Insurance, but publicly managed by a five-member Governing Board consisting of the Governor, the Treasurer, the Insurance Commissioner, the Senate President pro Tempore, and the Assembly Speaker. It is administering the **CEA Residential Retrofit Program**. This program refers homeowners to trained professionals who will strengthen their homes to resist earthquake damage and secure their water heaters to reduce the risk of fire following an earthquake. Upon completion of the retrofit, CEA policyholders will be eligible for an insurance premium discount of 5%. Non CEA policyholders should check with their insurance agent to determine whether their earthquake insurance company offers a retrofit discount. The program is ongoing.

After calling the CEA and answering a few simple questions about their home, homeowners are referred to a pre-qualified engineering firm that will inspect their home's foundation and prepare a report showing the weaknesses that can be corrected through retrofitting. Next, homeowners are referred to a contractor who will perform the work described in the engineering report. The CEA pre-screens all contractors and only contractors which are financially secure, trained, and licensed are eligible to participate in the Residential Retrofit Program.

Finally, the CEA helps homeowners pay for the retrofit by arranging low-interest loans through participating banks.

The Residential Retrofit Program is open to California homeowners:

- ◆ Only in Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Ventura counties (most counties were not added to the program until September 1999; only Santa Clara and Ventura were part of the original program in July 1998);
- ◆ Only wood-frame (or stucco over wood stud walls) homes built prior to 1979
- ◆ Only homes with a crawl space or an unbolted foundation
- ◆ Only homes without any pre-existing earthquake, water, or pest damage

You **do not** have to be a CEA policy-holder to participate in the program.

By making arrangements with various lending institutions, the California Earthquake Authority has made low-interest loans available to all participants who meet standard loan approval criteria. CEA Residential Retrofit Loans have an interest rate of 8.0% for non-CEA policyholders and 7.5% for CEA policyholders. The CEA and FannieMae will collaborate to provide low-interest loans. Homeowners not approved for the loan still have the option of continuing with the Program provided they make alternate financing arrangements. To date, the program has been responsible for 13 retrofits and 3 loans.

(Description based on oral and written communications from Shari Adabi, CEA
December 1998, January 1999, and August 1999)

The only pre-qualified engineering firm operating in Santa Clara County is QuakeSAFE. The firm estimates that they have issued approximately 140 engineering reports from July 1998 when the program started until mid-January 1999. However, less than 30 of those homeowners have requested a free contractor bid. No loans have been finalized. Of the 5 homeowners who plan to retrofit, two are in the process of applying for a CEA loan, and three plan to self-finance.

(Description based on oral communications from Michael Hayes, QuakeSAFE,
December 1998 and January 1999)

California Department of Insurance – Loan Program

The California Department of Insurance, through Bank of America, is offering a low-interest retrofit program to qualified borrowers. This program can be used for:

- ◆ single family through four-plex properties
- ◆ located in Alameda, Contra Costa, Humboldt, Imperial, Los Angeles, Mendocino, Orange, Riverside, San Bernardino, San Diego, San Francisco, San Mateo, Santa Clara and Santa Cruz counties.

The program is slated to continue until July 1, 2000. A property owner DOES NOT have to live in the subject property. This program can also be used for mobile homes. The bank will charge an interest rate of 4.5%. Funds provided to property owners through this program cannot exceed:

- ◆ \$6,000 for a mobile home
- ◆ \$8,000 for a single family home
- ◆ \$10,000 for a duplex
- ◆ \$12,500 for a tri-plex
- ◆ \$15,000 for a four-plex

Eligible retrofit procedures are listed in Table 3, below.

TABLE C3 – Eligible Procedures for California Department of Insurance Loan Program

Site-Built Homes	Mobile Homes
1 - Brace hot water heater 2 - Brace cripple wall 3 - Anchor foundation to structure 4 - Install automatic gas shut-off valves 5 - Repair foundation (to accommodate earthquake retrofit)	1 - Brace hot water heater 2 - Anchor fuel storage (if applicable) 3 - Install "Earthquake Resistance Bracing System"

The program is ongoing. *Since the program started in July 1998, only one loan has been approved.*

(Description based on oral and written communications from Margaret Montgomery, March 1999)

California Department of Insurance – Grant Program

The California Department of Insurance is currently offering a limited number of earthquake retrofit grants to low-to-moderate income homeowners. Grant funds can only be used for owner-occupied single family site-built *or* mobile homes. The grant program is being administered directly by the Department of Insurance.

The program has several caveats.

- ◆ The homeowners must live in selected counties and submit grant applications during a narrow time window. For example, the latest round of grants were open to homeowners in Contra Costa, San Mateo, Santa Clara, Orange, Imperial and Riverside counties for the period from November 24, 1998 through January 5, 1999.
- ◆ Grant funds cannot be used to upgrade previous Federal Emergency Management Agency (FEMA) recognized retrofitting of site-built or mobile homes.
- ◆ A site-built home has a maximum grant limit of \$8,000 and a mobile home has a maximum grant limit of \$6,000.
- ◆ Grantees must be low-to-moderate income homeowners and must have lived in the property for at least two years. Additionally, extra consideration is given to the financially neediest applicants who are on a fixed income, permanently disabled, and are 55 years old or older.

The program is ongoing. *From July 1998 through December 1998, 108 homes and mobile homes had seismic retrofit work paid for by this program, of which 6 were in Alameda County and the remainder were outside of the nine Bay Area counties.*

(Description based on oral and written communications from Margaret Montgomery and Walter Watson, December 1998 and February 1999)

ABAG Finance Authority for Nonprofit Corporations – Affordable Housing Program

The ABAG Finance Authority For Nonprofit Corporations (the "Authority") is a Joint Powers Agency formed to help eligible nonprofits and other borrowers to gain access to tax-exempt debt financing. The Authority simplifies the debt issuance process for both the borrower and the jurisdiction in which the borrower is located by issuing conduit tax-exempt bonds or certificates of participation to finance projects with demonstrated public benefit. The Authority has financed projects on behalf of:

- ◆ hospitals;
- ◆ health care clinics;
- ◆ retirement facilities;
- ◆ nonprofit housing developers;
- ◆ multifamily housing partnerships;
- ◆ private schools;
- ◆ behavioral health care agencies;
- ◆ substance abuse facilities; and
- ◆ community service organizations.

Projects financed by the Authority have involved facility acquisition and rehabilitation, equipment acquisition, and new construction. The Authority is one of several of ABAG's financial service programs, which currently provide an aggregate of approximately \$300 million to approximately 50 projects annually. However, these programs do not have any capacity limits on either the dollar amount of an individual financing project or the number of projects financed.

The Authority is managed by ABAG for member jurisdictions *throughout the State of California* and will only issue debt for projects located in those member jurisdictions. Any local jurisdiction in the state may become a member. Proposed projects must have the support of the member jurisdiction in which they are located.

One program of the Authority provides tax-exempt financing for the acquisition, construction and rehabilitation of multifamily and senior housing, to California 501 (c)(3) nonprofit housing developers, partnerships and for-profit entities with public benefit projects (such as affordable housing). Consistent with ABAG's long standing commitment to policy supporting affordable housing, the primary goals for this program are to provide low-cost financing for smaller urban projects and an efficient competitive lending vehicle for larger developments.

In March 1999, the Authority issued \$23 million in Revenue Certificates of Participation for Channing House, a nonprofit corporation which owns an 11-story building in Palo Alto, California. The building contains 232 Residential Care Facilities for the Elderly (RCFE) apartment units and seven rooms for skilled nursing services with 21 beds. The 232 RCFE units consist of 32 assisted-living units, 98 studio units, 89 one-bedroom units, and 12 two-bedroom units. By going through the Authority, the interest rate was only 5.25%. The funds are being spent for seismic strengthening of the building, as well as for installation of an additional freight elevator. The seismic retrofit designed by Rinne-Peterson involves putting the building on seismic isolators that reduce the earthquake forces transmitted up into the building. This retrofit design was chosen to minimize the construction disruption to the elderly occupants of the building.

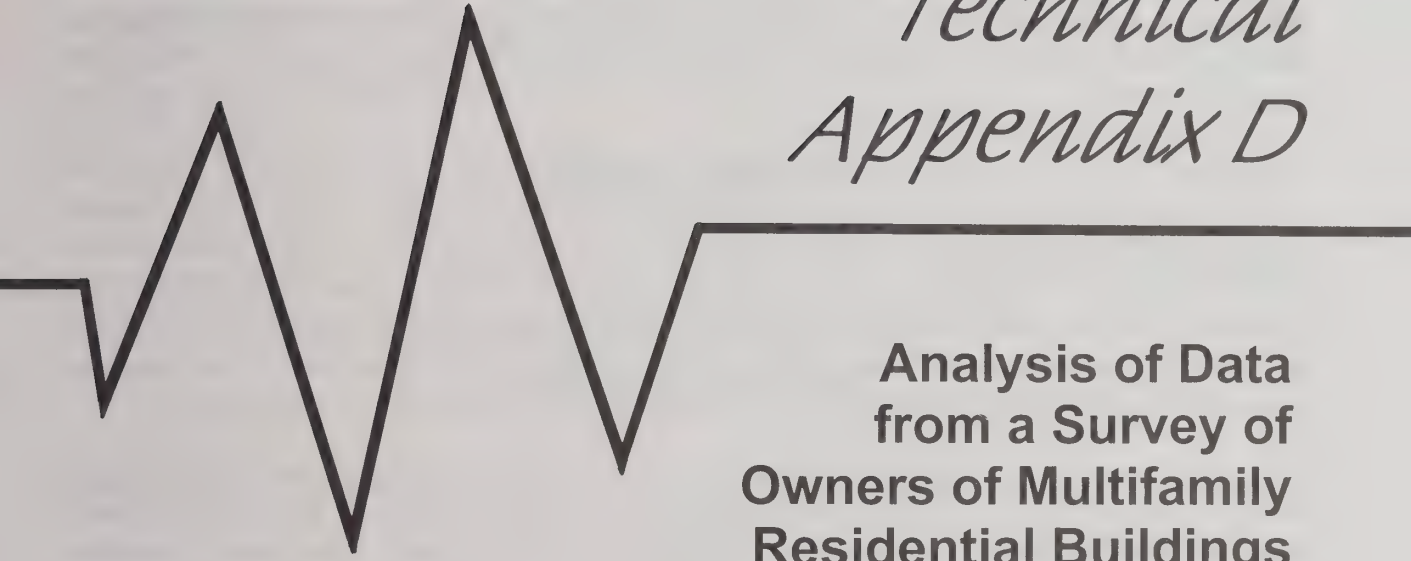
(Description from Clarke Howatt, Financial Services Director,
Association of Bay Area Governments, August 1999)



Technical Appendix D

Analysis of Data from a Survey of Owners of Multifamily Residential Buildings

This Appendix contains information on the percentages of owners of multifamily residential buildings responding to our survey that have retrofitted their buildings. These numbers are not an accurate measure of the actual percentage of residential building owners who have retrofitted because people who retrofitted were more likely to respond to our survey. Therefore, please use the percentages found in Appendix C as an estimate of actual retrofit rates. However, data on the reasons for retrofitting (from the sample of those who retrofit) and the reasons for not retrofitting (from the sample of those who have not retrofitted) contained in this Appendix are statistically valid.



Technical Appendix D

Analysis of Data from a Survey of Owners of Multifamily Residential Buildings

INTRODUCTION

The Association of Bay Area Governments (ABAG) conducted a multifamily earthquake retrofit survey in Berkeley and Oakland in the summer of 1999. This survey – along with a similar survey sent to single-family homeowners in the summer of 1998 – was undertaken to collect data on the reasons owners are currently retrofitting (or not retrofitting) housing. The data assisted in the design of a model program to be used by city and county governments to encourage residential earthquake retrofitting.

Multifamily surveys were sent to two different sample groups. One group included owners of multifamily properties in the City of Berkeley that had their permit fees waived because they planned to complete seismic work. The other sample group consisted of a random sample of owners of multifamily properties in Berkeley and Oakland acquired from MetroScan.

The random sample of Berkeley and Oakland multifamily properties included 69 addresses which were also included in the sample of Berkeley owners that received waived permit fees in order to keep the sample random. These addresses were not dropped from the Berkeley random sample. However, only one survey was mailed to the owners in both samples.

The response rates were relatively high. A total of 350 surveys were sent to multifamily property owners in Berkeley with waived permit fees, and 173, or 49.4%, of these with valid addresses were completed and returned. We mailed a total of 990 surveys to the random sample of Berkeley and Oakland multifamily properties with a combined response rate of 26.1% for the 258 returned. From this random sample, 176 of the 540 surveys sent to Berkeley were completed and returned for a 32.6% response rate, and 82 of the 450 Oakland surveys were completed and returned for an 18.2% response rate.

As we found in the survey sent to single-family homeowners, owners of properties that have retrofitted are more likely to have responded to our survey because retrofitting is a subject that interests them. Consequently, returned surveys are likely to over-represent property owners that have retrofitted.

SURVEY DESIGN

QUESTIONS INCLUDED

The survey was virtually the same one used in the earthquake retrofit survey sent to single-family homeowners (refer to “Survey Design” in Appendix A for more detail). The questions that were changed from the survey sent to single-family homeowners are discussed below.

A question asking for the number of units in the building (#2) was added because we thought owners with buildings with small and large numbers of units might retrofit at different rates. Additionally, if any surveys were returned from single-family homeowners due to inaccuracies in the address files, we believed that we could intercept them with this question.

The question about “living area (office, bedrooms, living room, etc.) above a garage” was rephrased to whether there was “parking or a garage on the first floor with living units above it” (#3). This change was made because multifamily residences often have a “soft” story dedicated to parking.

In the single-family survey we asked whether the homeowner had consulted with a structural engineer or architect prior to executing their retrofit work. “Architect” was removed from this question in the multifamily survey (#13) because it is more critical that the owner confers with a structural engineer for multifamily buildings.

In the survey sent to single-family homeowners, we asked, “Approximately how much money did you spend on the retrofit work?” However, many respondents stated the cost of an *entire* remodel, although the retrofit work was only a small part of that. As a result, this question was split in two. We asked how much money was spent on *all* work (#14a) and how much was spent on the *earthquake retrofit* work (#14b) in order to solve this problem.

Any retrofit work done by owners of multifamily properties would likely affect several units – not just one as in the case of single-family homeowners, and benefit their tenants. As a result, within the listed reasons of why retrofit work was completed, “I wanted to feel safer” was changed to “I wanted to feel safer or to have my tenants feel safer” (#15).

The question regarding whether or not the owner lives in the building (#F) was changed for the multifamily survey because of the added options available. Answers added to this question included “Yes, I live in a condo unit which I own,” “Yes, I own the entire building and live in one of the units,” “No, I rent out this condo unit,” and “No, I rent out all the units.”

Finally, the question asking the owner's age was removed due to space limitations and because this demographic characteristic had not been as significant as income or education as a predictor of retrofitting in the single-family homeowner survey.

PACKAGING OF SURVEY

The printed survey was almost identical to the survey sent to single-family homeowners (see Appendix A for details). The only change in this packaging was with regard to offering foreign language assistance. We did not include statements on the front page of the multifamily survey in other languages about the existence of a language hotline. We received very few calls for this assistance in the course of the last survey, and therefore viewed this service as unnecessary.

SITE SELECTION

SELECTION OF CITIES

Although our single-family housing survey was sent to homeowners in 17 jurisdictions, we focused the multifamily housing survey on only the cities of Berkeley and Oakland for several reasons.

- ◆ These cities were chosen because they were the two on which we were able to gather the most data through the American Society of Home Inspectors (ASHI) (refer to Appendix B for details on this ASHI survey). As a result, we were able to check for any skewing of the results from the survey sent to multifamily property owners by comparing this data with the ASHI data.
- ◆ The ASHI survey indicated that only owners in Berkeley were retrofitting significant numbers of multifamily properties. We believed that the multifamily survey would provide us with insight as to why these owners are retrofitting in Berkeley.
- ◆ Studying Berkeley would give us the added bonus of finding out the effects of the City of Berkeley's retrofit program – from both the permit fee waivers and the transfer tax rebate (detailed in Appendix A) – on the retrofit of multifamily properties.
- ◆ Oakland is located adjacent to Berkeley but has not had a retrofit incentive program in place until recently. Therefore we believed it to be a good city to use for comparability.

For further information on the demographics and history of Berkeley and Oakland, please refer to Appendix A.

BACKGROUND INFORMATION ON PERMIT FILE PROPERTIES

The City of Berkeley sent us a list of 470 multifamily properties where permit fees were waived to do retrofit work.¹ The addresses of these properties were coded into ABAG's geographic

¹ The City of Berkeley originally gave us a list of 1,618 properties that had their permit fees waived because the owners intended to complete seismic work on the properties. We removed the properties listed by the City of Berkeley as single-family homes and sent the addresses of the remaining 470 properties to MetroScan. MetroScan was able to find information on 350 of these properties and surveys were sent to this group (MetroScan was not able to find the remaining 120 addresses in their databases).

information system. They were randomly scattered throughout the City and not located in particular neighborhoods.

Next, we conducted a windshield survey of Berkeley multifamily properties whose owners had their fees waived to do seismic work. According to the City of Berkeley, these residential properties were either unreinforced masonry buildings (URMs) or small multifamily buildings with less than five units. We looked at a random sample of 52 of these 470 properties. We were particularly interested in whether small multifamily buildings in Berkeley being retrofitted were traditional apartment buildings or were single-family homes that had been converted to apartments. Additionally, we were interested in defining the use codes in Berkeley's file of waived permits since many use classifications appeared to be redundant.²

Although Berkeley has a mixture of different multifamily housing, a majority of small multifamily buildings being retrofitted appeared to be single-family homes that had been converted into apartments. As for the use codes, some of them were easily understandable while others did not appear to follow any set pattern and seemed to indeed be redundant. Additionally, several of the properties appeared to be single-family homes despite the City's use codes, which stated that these were multifamily properties. Overall, the sample only partly consisted of small multifamily buildings, and seemed to be well represented by *all* sizes of multifamily buildings – buildings with both small and large numbers of units.

The permit list was given to MetroScan – a subsidiary of the Trans America Corporation which has access to county assessor's data files – and they were able to provide data on 350 of the properties to which we then sent surveys. MetroScan provided critical information needed to conduct the survey, such as the properties' site addresses and the owners' mailing addresses. In addition the MetroScan data included information about the building such as the decade built, the number of units and stories, the date of purchase, and the square footage.

SELECTION OF RANDOM SAMPLE BUILDINGS

We also acquired MetroScan data in order to send out surveys to random samples of multifamily properties throughout Berkeley and Oakland. Unlike the single-family housing survey, the multifamily housing survey was *not* sent to select census tracts. The sample included 10% of Berkeley's multifamily buildings, and 3% of Oakland's multifamily housing stock.

In Berkeley, 69 addresses that were included in the random sample of owners of multifamily buildings in Berkeley also were in the list of Berkeley properties that received permit fee waivers for retrofit work. As a result, completed surveys on these buildings were included in the results for *both* samples in order to keep the random sample of Berkeley multifamily buildings truly random.

In Berkeley the sample included 10% of the City's multifamily buildings. However, uses that were listed as church homes, restricted income multifamily, and 5+ unit single-family homes

² One example of these redundant use codes was in the classifications "home plus two living units" and "triplex" which sounded like the same property type.

were excluded from our sample. There were only two of these use types in all of Berkeley, and the odds were against the 10% sample selecting these buildings anyway.

In Oakland the sample covered 3% of the City's multifamily housing stock. We did not exclude the use types for Oakland that had been excluded for Berkeley because there were more examples of these use types in Oakland. However, we did exclude the use type of mobile homes that were categorized as multifamily.

Although we took a random sample of owners by census tract for the survey sent out to single-family homeowners in order to keep track of any skewing, we decided not to do this for the multifamily survey. Because of the fewer addresses in the multifamily sample, we would not have been able to track skewing by census tract.

Finally, the sample used for the single-family survey was confined to pre-1960s homes. However, for the samples we used for the multifamily survey we made no such stipulation because we believed that all multifamily buildings needed to be retrofitted. According to data from ABAG's "Shaken Awake!" report, many woodframe multifamily buildings built after 1940 would be rendered uninhabitable by a major earthquake, in large part due to problems with "tucked under" parking.

SURVEY PROCEDURES

SURVEY MAIL-OUT AND RESPONSE RATES

A postcard was mailed out to all of the multifamily samples on June 23, 1999. The survey was sent to MetroScan's random sample of Berkeley and Oakland multifamily properties over a seven-day period beginning on June 23, 1999. Although we attempted to send out the postcard before the survey, there may have been some overlap. A total of 195 of the 1,172 surveys with valid addresses were returned after the original survey was mailed out, achieving a response rate of 16.6%.

On July 14, 1999 a reminder postcard was mailed to multifamily building owners who had not yet responded to the survey. Consequently, the response rate after mailing out the original survey and the reminder postcard was boosted to 21.8%.

A second survey was mailed out July 27, 1999, bringing the total response rate to 33.1%. During this time a few people called ABAG and opted to take the survey over the phone while an employee read the questions.

Because we had a relatively low response rate from Oakland owners compared to Berkeley, we mailed out another reminder postcard August 6, 1999 to Oakland multifamily building owners. These were signed by Mary King from the Alameda County Board of Supervisors to try to increase the response rate. After *all* of the survey and postcard mailings to Berkeley and Oakland residents, the final overall response rate was 33.9%.

The additional postcard and survey mailings after the original survey mail-out were an attempt to raise the response rate to statistically significant levels.

Furthermore, a “Thank You Flier” was mailed to everyone that participated in the survey, and included information on how to retrofit and prepare for an earthquake.

SURVEY PROCEDURES AFTER MAIL-OUT

A total of 95 of the 1,271 original mailed surveys were “bounced back” to ABAG by the post office as undeliverable – usually because the owner’s address had changed. We found the building owner’s new address whenever possible in order to mail out a new survey. An additional 4 unanswered surveys were received during the course of the multifamily survey.

A total of 85 of the 397 completed surveys, or 21.4%, were returned by owners of single-family – not multifamily – homes. From Berkeley’s sample of owners with waived permit fees, 50 of the 173 surveys, or 28.9%, received were for single-family homes. In the course of our review of buildings that had waived permit fees, we suspected that quite a few of the properties were single-family homes, although the City of Berkeley had listed them as multifamily properties. However, the number of single-family homes represented in the multifamily survey is far beyond what we expected. We also received surveys back for single-family homes from MetroScan’s random sample of Berkeley and Oakland multifamily buildings. However, the number of single-family homes comprises a significantly lower share of the total received surveys – 33 out of 176, or 18.8% in Berkeley and 9 out of 82, or 11.0% in Oakland.

RESPONSE RATES

TOTAL SAMPLE

The total response rate for valid multifamily surveys was 28.7%, which was a fairly high response rate considering the complexity of the retrofit questions. Berkeley’s permit sample had the highest response rate of the three samples, with 42.4% multifamily building owners returning the survey. The random sample of Berkeley multifamily buildings was next highest with a 29.9% response rate, and Oakland had the lowest response rate overall with 19.3% returning the retrofit survey. The response rate was high enough to make the results from each sample group statistically valid (refer to *TABLE D1 – Response Rates for Multifamily Housing Survey*).

TABLE D1 - RESPONSE RATES FOR MULTIFAMILY HOUSING SURVEY

Sample Source	Number Mailed	Number Responded			Number Undeliver/Incomplete	% Total Responded	% Valid Multi-Family Surveys
		Multi-Family	Single Family	Total			
Berkeley Permits	350	123	50	173	10	50.9%	42.4%
Berkeley Sample	540	143	33	176	29	34.4%	29.9%
Oakland Sample	450	73	9	82	63	21.2%	19.3%
Total	1271	312	85	397	99	33.9%	28.7%

Note 1. Adding together the numbers in the chart for responses by sample doesn't add up to the total given because 69 addresses were included in both the Berkeley permit sample and the Berkeley MetroScan sample.

Note 2. Only multi-family surveys, not single-family, are included in "valid multi-family surveys."

BY NUMBER OF UNITS

We believed that buildings with fewer units might have a greater rate of retrofit, partly because smaller multifamily buildings would cost less to retrofit. Often such 2-4 unit buildings are older homes that have been converted into apartments. As a result, retrofitting such buildings would be like retrofitting a house, without the worry of "soft" story parking that is often found in larger apartment buildings. In addition, unlike larger buildings that might be run by corporations, in smaller buildings the owner is probably more personally involved with the tenants and the building operation, and is more likely to be concerned with tenant safety.

Because we believed that the number of units in the building could skew the retrofit rate, we looked at the response rate from owners of different size buildings in order to monitor possible skewing. Overall, looking at the distribution of different size buildings throughout the Berkeley and Oakland random samples, it is evident that there are many 2-4 unit buildings in the two cities – particularly in Berkeley. Owners with smaller multifamily buildings also generally seemed to have higher response rates (refer to *TABLE D2 – Response Rates Based on Number of Units in Building*).

TABLE D2 - Response Rates Based on Number of Units in Building

Sample Source	Number of Units in Building								
	2-4 Units			5-19 Units			20+ Units		
	Number Received	Number Mailed	Response Rate	Number Received	Number Mailed	Response Rate	Number Received	Number Mailed	Response Rate
Berkeley Permits	143	267	53.6%	9	44	20.5%	4	8	50.0%
Berkeley Sample	146	412	35.4%	21	95	22.1%	2	8	25.0%
Oakland Sample	58	342	17.0%	11	54	20.4%	7	35	20.0%

Note 1. The unit information reflects MetroScan data, not self-reported survey data. This is because the self-reported data does not always agree with the MetroScan data (which was needed to calculate the total universe of respondents).

In Berkeley's permit sample, the response rate for owners of 2-4 unit buildings was 33.1% higher than that of 5-19 unit buildings. Similarly, this rate was also 13.3% among owners in the Berkeley random sample. There were very few buildings included in the Berkeley samples that

had 20 or more units. Although the response rate for owners of buildings with 20 or more units is higher than those with 5-19 units, because there are so few owners of buildings this large, these numbers are not statistically valid.

In Oakland, the response rate among owners of 5-19 unit buildings was 3.4% *higher* than that of owners of 2-4 unit buildings. In Oakland there is a large supply of buildings with 20 or more units, and the response rate from this group was nearly the same as for 5-19 unit buildings.

BY WHERE THE OWNER LIVES

We were also concerned that where the owner lived – whether in the multifamily building, in the same city as the building, in the rest of the Bay Area, in the rest of California, or outside of California – could affect retrofit rates. We believed that owner-occupied buildings would more likely be retrofitted because of the personal safety and involvement of the building owner. Additionally, we believed that owners that lived away from the building – particularly those living outside of the Bay Area or out of state – would be less inclined to retrofit the building. As a result, we examined the response rate of owners based on where they live in order to monitor any skewing.

The random sample in Berkeley particularly, identified a high number of owner-occupants in the multifamily housing stock. Very few owners in any of the samples lived outside of the Bay Area (refer to *TABLE D3 – Response Rates Based on Where Owner Lives*).

TABLE D3 - Response Rates Based on Where Owner Lives

Where Owner Lives	Sample Source								
	Berkeley Permits			Berkeley Sample			Oakland Sample		
	Number Received	Number Mailed	Response Rate	Number Received	Number Mailed	Response Rate	Number Received	Number Mailed	Response Rate
Lives in Unit in Building	128	240	53.3%	118	319	37.0%	29	166	17.5%
Lives in Same City	24	64	37.5%	23	94	24.5%	28	135	20.7%
Lives in Bay Area	18	39	46.2%	29	111	26.1%	23	140	16.4%
Lives in California	1	4	25.0%	4	10	40.0%	1	7	14.3%
Lives Outside of California	2	3	66.7%	2	6	33.3%	1	2	50.0%

Note 1. "Lives in Same City" does not include buildings which fell into the previous "Lives in Unit in Building" category. Similarly, "Lives in Bay Area" does not include buildings which fell into the previous categories, "Lives in Unit in Same City" or "Lives in Unit in Building," and so on.

Note 2. The Bay Area was defined as the nine-county Bay Area, which includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties.

Note 3. Information on where the owner lives was taken from MetroScan data, not self-reported survey data. This is because the self-reported data does not always agree with the MetroScan data (which was needed to calculate the total universe of respondents).

We expected there to be a drop off in response rate at each successive category of where the owner lived. However, the results were not highly skewed, showing a respectable response rate across all categories for where the owner lives.

Among respondents from the Berkeley permit sample and the Berkeley random sample, there were 15.8% and 12.5% increases respectively in the response rate for owner-occupants of multifamily buildings versus owners living elsewhere in Berkeley. Additionally, among both samples there was an increased response rate for owners that lived in a city other than Berkeley in the Bay Area over those who lived in Berkeley (but not the multifamily building in question).

On the other hand, in Oakland, there was a 3.2% higher response rate among owners that lived in Oakland but in a different building over those that were owner-occupants. In addition, the response rate for owner-occupants was not substantially higher than the response rate of owners who lived outside of Oakland in the Bay Area. Although there were fairly high response rates in all the sample groups for owners that lived outside the Bay Area, these results were not statistically significant.

TOTAL SAMPLE RESULTS

RETROFITTING DEFINITION

The several definitions of retrofit used for the multifamily survey were virtually identical to those used in the single-family survey. The only major difference in retrofit definitions between the two surveys was in the definition of a reasonably complete retrofit. Because many multifamily residential buildings have a “soft” story or “tucked under” parking - meaning that there is living space above a first floor garage - they are particularly vulnerable to structural damage in earthquakes. Therefore, our definition of a reasonably complete retrofit was more stringent for these types of buildings.

For the most part, we assumed that questions left unanswered signified that no structural or nonstructural measures had taken place.

At Least Partially Retrofitted

As in the single-family survey, for a building to have been at least partially retrofitted, at least some structural work had to have been done on the building either by the current owner or by previous owners. This structural work could consist of foundation bolting, adding plywood to the crawlspace, or strengthening the garage door opening. We assumed that for buildings built in or after 1950, bolts were part of the original building construction. Therefore, for structural work by a previous owner to count, bolts could *not* have been the structural measure taken. However, if for a building built in or after 1950, the current owner stated that they had acted to bolt the building, we assumed that extra bolts had been added to the foundation. Consequently, such buildings were regarded as at least partially retrofitted.

Full (or Reasonably Complete) Retrofit

To meet our definition of a reasonably complete retrofit, the building had to fulfill all the surveyed structural measures – foundation bolting, plywood in the crawlspace, and a strengthened garage door opening if there was a living area above the garage. Our definition of a reasonably complete retrofit differed with the definition used in Appendix A with regards to the

structural integrity of the garage. Multifamily residential buildings often have parking above which there is living space. This “soft” story is particularly vulnerable in an earthquake. Therefore, our definition of a reasonably complete retrofit took into account whether or not there was living space above the garage. If the other retrofit measures were taken, the building could have met the definition of a reasonably complete retrofit if:

- ◆ The garage did not have residential living space above it;
- ◆ The building owner didn’t answer whether or not there was living space above; and
- ◆ There was no garage or it was detached.

In addition, there were other exceptions in which the building could still count as a reasonably complete retrofit. Since buildings constructed in or after 1950 were assumed to be bolted, bolting did not need to have been done to meet the reasonably complete retrofit criteria. In addition, if there was no crawlspace or it was inaccessible, the owner was not required to add plywood to it in order to count as a reasonably complete retrofit. As in the single-family survey retrofit definition, it was possible that a building could be categorized as a reasonably complete retrofit and also be categorized as not partially retrofitted. This discrepancy could potentially occur because of buildings built in or after 1950 that had foundation bolting but no plywood. This is because such buildings with bolting but with inaccessible crawlspaces or no crawlspaces were defined as reasonably complete retrofits. However, such buildings built in or after 1950 were required to have had plywood added to the crawlspace – regardless of whether or not there was a crawlspace or it was inaccessible – to be defined as at least partially retrofitted. Therefore, in these cases such buildings could be defined as both not partially retrofitted and a reasonably complete retrofit.

Acted to Retrofit

Acting to retrofit signified that the current owner had taken at least one structural retrofit measure. These measures were foundation bolting, adding plywood to the crawlspace, or strengthening the garage door opening. For this definition, it did not matter what year the building was built, only that the owner had actively retrofitted.

Retrofit Before Purchase by Current Owner

The building was found to be retrofitted before being purchased by the current owner if the previous owner had installed bolts in a pre-1950s building, or, regardless of the year the building was built, had added plywood to the crawlspace or strengthened the garage door opening.

STRUCTURAL MEASURES

The overall sample results for the following structural measures as well as demographics and housing characteristics can be found in *TABLE D4 – Total Sample Results*.

TABLE D4 - Total Sample Results

For purposes of simplicity we've aggregated all responses to the survey in this table. However, the percentages are not indicative of Berkeley, Oakland, or Bay Area averages but rather the percentages of those responding to the multifamily building owner survey.

Part 1

1. How many stories high is this building (above ground, including parking)

Number of Stories	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
1 story	26	21.3%	14	10.1%	4	5.9%
2 stories	71	58.2%	99	71.2%	47	69.1%
3+ stories	25	20.5%	26	18.7%	17	25.0%

1 story includes 1.5 stories, 2 stories includes 2.5 stories.

2. How many units are in this building?

(The question was open-ended. We sorted the data into categories.)

Number of Units	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
2-4 Units	107	87.7%	120	85.1%	50	70.4%
5-19 Units	11	9.0%	19	13.5%	15	21.1%
20+ Units	4	3.3%	2	1.4%	6	8.5%

3. Is there parking or a garage on the first floor with living units above it?

Parking with Units Above	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, the entire first floor	6	5.1%	9	6.5%	6	8.7%
Yes, part of the first floor	19	16.1%	22	15.8%	9	13.0%
No	93	78.8%	108	77.7%	54	78.3%

4. What is the approximate decade this building was originally built?

(The question was open-ended. We sorted the data into categories.)

Decade Building Built	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
<1900	9	7.6%	8	5.9%	4	6.5%
1900-1909	23	19.3%	29	21.5%	11	17.7%
1910-1919	19	16.0%	29	21.5%	8	12.9%
1920-1929	34	28.6%	23	17.0%	9	14.5%
1930-1939	5	4.2%	9	6.7%	8	12.9%
1940-1949	14	11.8%	6	4.4%	5	8.1%
1950-1959	7	5.9%	11	8.1%	5	8.1%
1960-1969	5	4.2%	12	8.9%	1	1.6%

(Responses continued on next page)

TABLE D4 - Total Sample Results (continued)

Decade Building Built	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
1970-1979	1	0.8%	5	3.7%	4	6.5%
1980-1989	0	0.0%	0	0.0%	2	3.2%
1990+	2	1.7%	3	2.2%	5	8.1%

5. *Has this building been substantially changed with a major renovation?*

Bldg Changed with Renovation	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	49	43.8%	55	41.0%	24	36.9%
No	63	56.3%	79	59.0%	41	63.1%

6. *Which of the following precautions have been taken for this building, and when did they occur? These are called nonstructural measures.*

a. *All water heaters are braced or strapped to a wall?*

Water Heater Braced	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, before I bought building	45	36.6%	44	30.8%	22	30.1%
Yes, after I bought building	69	56.1%	76	53.1%	32	43.8%
No	6	4.9%	19	13.3%	12	16.4%
(Yes before AND after bought)	0	0.0%	0	0.0%	0	0.0%
(Doesn't know or no response)	3	2.4%	4	2.8%	7	9.6%

b. *The chimney(s) is braced?*

Chimney Is Braced	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, before I bought building	21	17.1%	17	11.9%	11	15.1%
Yes, after I bought building	15	12.2%	12	8.4%	1	1.4%
No chimneys	37	30.1%	54	37.8%	40	54.8%
No	46	37.4%	50	35.0%	17	23.3%
(Yes before AND after bought)	0	0.0%	1	0.7%	0	0.0%
(Doesn't know or no response)	4	3.3%	9	6.3%	4	5.5%

c. *A special gas shut-off valve triggered by shaking or a gas leak detector is installed?*

Gas Shut-Off Valve Is Installed	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, before I bought building	3	2.4%	8	5.6%	10	13.7%
Yes, after I bought building	12	9.8%	10	7.0%	3	4.1%
No	91	74.0%	106	74.1%	48	65.8%
(Yes before AND after bought)	0	0.0%	0	0.0%	0	0.0%
(Doesn't know or no response)	17	13.8%	19	13.3%	12	16.4%

TABLE D4 - Total Sample Results (continued)

Overall, we calculated whether any nonstructural measures had been taken by the previous or current owner:

Nonstructural Measures	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Nonstructural measures taken	115	93.5%	121	84.6%	57	78.1%
No nonstruct. Measures taken	8	6.5%	22	15.4%	16	21.9%

7. Which one of the following structural measures have been taken for this building, and when did they occur?

d. The building is bolted to its foundation?

Building Bolted to Foundation	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, before I bought building	21	17.1%	44	30.8%	31	42.5%
Yes, after I bought building	92	74.8%	62	43.4%	16	21.9%
No	5	4.1%	24	16.8%	19	26.0%
(Yes before AND after bought)	0	0.0%	0	0.0%	0	0.0%
(Doesn't know or no response)	5	4.1%	13	9.1%	7	9.6%

e. Plywood has been added in the crawl space?

Plywood in Crawl Space	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, before I bought building	13	10.6%	15	10.5%	9	12.3%
Yes, after I bought building	74	60.2%	48	33.6%	10	13.7%
No crawl space	16	13.0%	28	19.6%	23	31.5%
No	15	12.2%	36	25.2%	23	31.5%
(Yes before AND after bought)	0	0.0%	0	0.0%	0	0.0%
(Doesn't know or no response)	5	4.1%	16	11.2%	8	11.0%

f. Additional strengthening of a garage door opening or parking area has occurred?

Strengthening of Garage Door	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, before I bought building	1	0.8%	0	0.0%	9	12.3%
Yes, after I bought building	23	18.7%	17	11.9%	10	13.7%
No parking or detached	66	53.7%	75	52.4%	34	46.6%
No	25	20.3%	40	28.0%	12	16.4%
(Yes before AND after bought)	0	0.0%	0	0.0%	0	0.0%
(Doesn't know or no response)	8	6.5%	11	7.7%	8	11.0%

TABLE D4 - Total Sample Results (continued)

Citing our previous definition of retrofit, we calculated the structural retrofit rates of building owners. We assumed that if they left the question blank that the respondent had not retrofitted.

At Least Partially Retrofitted	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Building partially retrofitted	117	95.1%	102	71.3%	47	64.4%
Building not partially retrofitted	6	4.9%	41	28.7%	26	35.6%

Reasonably Complete Retrofit	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Reasonably complete retrofit	95	77.2%	76	53.1%	33	45.2%
Not reasonably complete retro.	28	22.8%	67	46.9%	40	54.8%

Acted to at Least Partially Retrofit Building	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Acted to retrofit building	102	82.9%	71	49.7%	21	28.8%
Did not act to retrofit building	21	17.1%	72	50.3%	52	71.2%

Retrofitted in Some Way Before Purchased by Owner	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Retrofitted before purchase	24	19.5%	38	26.6%	28	38.4%
No retrofitted before purchase	99	80.5%	105	73.4%	45	61.6%

The number of those who acted to at least partially retrofit added to the number of respondents whose buildings were partially retrofitted before they were purchased, is slightly higher than the *total* number of respondents with retrofitted buildings. This is because some owners both bought an already retrofitted building *and* acted to further strengthen it.

8. *For those responses in Question 7 where no structural work has occurred, why have you decided not to do that work on this building?*

(To see this table refer to D5 – *Why Structural Work Was Not Done.*)

9. *If any earthquake strengthening was done before you purchased this building, was it a factor in your decision to purchase this building?*

Retrofit Was Buying Factor	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, a lot	4	3.5%	9	7.0%	9	13.2%
Somewhat	14	12.4%	18	14.0%	9	13.2%
Not much	14	12.4%	12	9.3%	4	5.9%
Not at all	20	17.7%	23	17.8%	16	23.5%
Not applicable	61	54.0%	67	51.9%	30	44.1%

TABLE D4 - Total Sample Results (continued)

10. *Date(s) work was done: (Fill in year, If you've done more than one strengthening project, list years.)*

Date work was done	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
<1980	0	0.0%	0	0.0%	0	0.0%
1980-1989	2	1.8%	4	5.6%	0	0.0%
1990+	107	98.2%	67	94.4%	19	100.0%

Since some building owners listed many years, only the *last* year that work was done was included in the calculations.

11. *Who did the retrofit work?*

Who Did Work	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Did work themselves	10	8.9%	16	20.8%	8	34.8%
Hired contractor to do work	88	78.6%	51	66.2%	6	26.1%
Did some work & contractor	14	12.5%	10	13.0%	9	39.1%

12. *How did you pay for the work?*

How Paid for Work	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Loan or refinance	21	19.3%	13	17.1%	5	20.8%
Cash or credit card	80	73.4%	58	76.3%	19	79.2%
Support from gov't program	28	25.7%	25	32.9%	3	12.5%
Total (Answered at least one)	109		76		24	

Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to at least one of these questions, and not out of the total number of respondents.

13. *Did you hire or talk with a structural engineer prior to retrofitting this building?*

Talked to Structural Engineer	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	65	59.6%	42	53.8%	11	45.8%
No	44	40.4%	36	46.2%	13	54.2%

TABLE D4 - Total Sample Results (continued)

14a. Approximately how much money did you spend on all work?

(The question was open-ended. We sorted the data into categories.)

Amount Spent on All Work	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
<\$500	1	1.1%	1	1.5%	0	0.0%
\$500-\$999	3	3.4%	2	3.1%	0	0.0%
\$1,000-\$1,999	5	5.6%	5	7.7%	0	0.0%
\$2,000-\$2,999	11	12.4%	8	12.3%	1	5.9%
\$3,000-\$3,999	10	11.2%	4	6.2%	1	5.9%
\$4,000-\$4,999	3	3.4%	4	6.2%	0	0.0%
\$5,000-\$5,999	4	4.5%	3	4.6%	2	11.8%
\$6,000-\$9,999	7	7.9%	5	7.7%	0	0.0%
\$10,000-\$14,999	4	4.5%	7	10.8%	3	17.6%
\$15,000-\$19,999	5	5.6%	5	7.7%	0	0.0%
\$20,000-\$24,999	1	1.1%	3	4.6%	2	11.8%
\$25,000-\$29,999	8	9.0%	4	6.2%	0	0.0%
\$30,000-\$34,999	6	6.7%	3	4.6%	0	0.0%
\$35,000-\$39,999	1	1.1%	2	3.1%	0	0.0%
\$40,000+	20	22.5%	9	13.8%	8	47.1%

Average Amount Spent \$37,254

14b. Approximately how much money did you spend on the earthquake retrofit work?

Amount Spent on EQ Work	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
<\$500	2	2.3%	2	3.4%	0	0.0%
\$500-\$999	3	3.4%	2	3.4%	0	0.0%
\$1,000-\$1,999	8	9.2%	7	11.9%	1	7.1%
\$2,000-\$2,999	11	12.6%	8	13.6%	2	14.3%
\$3,000-\$3,999	9	10.3%	6	10.2%	1	7.1%
\$4,000-\$4,999	3	3.4%	5	8.5%	0	0.0%
\$5,000-\$5,999	7	8.0%	2	3.4%	2	14.3%
\$6,000-\$9,999	10	11.5%	4	6.8%	2	14.3%
\$10,000-\$14,999	7	8.0%	6	10.2%	1	7.1%
\$15,000-\$19,999	5	5.7%	6	10.2%	0	0.0%
\$20,000-\$24,999	7	8.0%	3	5.1%	2	14.3%
\$25,000-\$29,999	6	6.9%	3	5.1%	1	7.1%
\$30,000-\$34,999	4	4.6%	0	0.0%	0	0.0%
\$35,000-\$39,999	1	1.1%	0	0.0%	0	0.0%
\$40,000+	4	4.6%	5	8.5%	2	14.3%

Average Amount Spent \$13,006

15. Why did you decide to do the work?

(To see this table refer to *TABLE D6 – Why Structural Work Was Done.*)

TABLE D4 - Total Sample Results (continued)**Part II***A. Where did you live in 1989 when the Loma Prieta earthquake happened?*

Where Lived in 1989	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
In this building	26	21.5%	22	15.8%	6	8.7%
Not in this building but in Calif	77	63.6%	97	69.8%	57	82.6%
Outside of California	18	14.9%	20	14.4%	6	8.7%

B. Have you ever experienced a major damaging earthquake?

Experienced Major EQ	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	75	63.0%	76	55.9%	45	67.2%
No	44	37.0%	60	44.1%	22	32.8%

C. What do you believe is the risk of a future major Bay Area earthquake?

Risk of Major Bay Area EQ	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Very high	80	67.2%	72	54.1%	29	43.3%
Moderately high	36	30.3%	53	39.8%	26	38.8%
Moderately low	3	2.5%	6	4.5%	11	16.4%
Very low	0	0.0%	2	1.5%	1	1.5%

D. Do you know someone (such as a friend or neighbor) who has done additional structural work on their home or rental to provide for additional safety in an earthquake?

Has Friend Who Did Work	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	84	74.3%	83	62.4%	31	45.6%
No	29	25.7%	50	37.6%	37	54.4%

E. Have you seen ABAG's earthquake shaking maps for the city where this building is located?

Has Seen ABAG's EQ Maps	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	37	31.6%	28	20.9%	11	16.9%
No	80	68.4%	106	79.1%	54	83.1%

TABLE D4 - Total Sample Results (continued)*F. Do you live in this building?*

Owners Lives in Building	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, lives in condo & owns it	26	21.7%	23	16.8%	7	10.4%
Yes, owns bldg & lives in unit	60	50.0%	77	56.2%	20	29.9%
No, rents out this condo unit	4	3.3%	2	1.5%	1	1.5%
No, rents out all the units	24	20.0%	32	23.4%	35	52.2%
No, it is vacant	6	5.0%	3	2.2%	4	6.0%

G. Do you have earthquake insurance for this building?

Has EQ Insurance for Bldg	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	43	35.5%	30	21.7%	7	10.8%
No, but I used to	16	13.2%	21	15.2%	8	12.3%
No, never had insur. for bldg	62	51.2%	87	63.0%	50	76.9%

H. Do you have food and water at your home to help you survive after an earthquake?

Food and Water at Home	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes, for more than 4 days	19	15.8%	29	21.0%	18	28.1%
Yes, for 3-4 days	34	28.3%	28	20.3%	11	17.2%
Yes, for 1-2 days	36	30.0%	40	29.0%	17	26.6%
No	31	25.8%	41	29.7%	18	28.1%

I. How much school have you completed?

Amount of School Completed	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Did not complete high school	0	0.0%	2	1.5%	8	12.1%
Graduated from high school	9	7.4%	21	15.4%	21	31.8%
Graduated from college	112	92.6%	113	83.1%	37	56.1%

J. What is your approximate family income?

Approximate Family Income	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Less than \$20,000/year	8	7.5%	4	3.1%	5	7.9%
\$20,000-\$39,999/year	8	7.5%	22	16.9%	20	31.7%
\$40,000-\$59,999/year	26	24.5%	23	17.7%	11	17.5%
\$60,000-\$79,999/year	14	13.2%	31	23.8%	10	15.9%
\$80,000-\$99,999/year	19	17.9%	20	15.4%	7	11.1%
More than \$100,000/year	31	29.2%	30	23.1%	10	15.9%

TABLE D4 - Total Sample Results (continued)

K. May we contact you if we have any questions?

Can Be Contacted by ABAG	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	#	%	#	%	#	%
Yes	70	60.3%	71	52.6%	40	58.8%
No	46	39.7%	64	47.4%	28	41.2%

From the random sample of multi-family building owners, foundation bolting was the most common structural measure taken, with 74.2% of Berkeley buildings and 64.4% of Oakland building owners citing this measure. Although most of these Berkeley owners had completed the foundation bolting since they bought the house, the work in Oakland had been predominantly done by previous owners. Not surprisingly, among building owners in Berkeley that received a permit waiver for structural work, 91.9% had done foundation bolting. Oddly enough, 4.1% of the buildings in this sample did not have *any* foundation bolting.

Similar retrofit rates were found among the other measures of structural retrofit. According to the results from the random sample of multi-family building owners, 44.1% of Berkeley owners and 26.0% of Oakland owners had buildings where plywood had been added to the crawlspace. However, a significant population did not have a crawl space to begin with – particularly in Oakland. Of those receiving a permit fee waiver in Berkeley, 70.8% added plywood to the building’s crawlspace while 12.2% reported that they had not. Strengthening of the garage door opening was the least common structural measure taken, having been completed by 11.9% of owners in the Berkeley random sample, and 26.0% of the Oakland owners. However, the majority of owners in Berkeley and Oakland stated that they didn’t have parking or that it was detached. Among Berkeley owners receiving the permit fee waiver, only 19.5% had strengthened the garage door opening, and 20.3% reported that they had not.

Using the definitions of retrofit defined earlier in this report, structural retrofit rates were calculated among the three sample groups. Among the respondents to the survey from the random sample, the building had been at least partially retrofitted by 71.3% of Berkeley respondents and 64.4% of Oakland respondents. Of those respondents that received permit fee waivers to complete structural work, 95.1% of their buildings had been at least partially retrofitted, and a surprising 4.9% had not. In addition, the rate of reasonably complete retrofit was 77.2% among this group. Within the random sample, 53.1% of Berkeley buildings had a reasonably complete retrofit, compared to 45.2% of Oakland buildings.

From the random sample, Berkeley building owners were 20.9% more likely to have acted to retrofit multifamily housing than Oakland owners, with 49.7% of Berkeley building owners and 28.8% of Oakland owners acting to at least partially retrofit. However, only 26.6% of these Berkeley respondents, compared to 38.4% in Oakland, owned buildings that had been retrofitted in some way before they purchased them. Among Berkeley respondents that received the fee waiver, 82.9% had acted to at least partially retrofit, and 19.5% owned buildings that had been retrofitted in some way before they were purchased.

The most common reason of respondents from the random sample for not taking care of structural work was “I don’t know what I need to do” mentioned by 37.7% of Berkeley respondents and 55.0% of Oakland respondents. In Berkeley this answer was tied for the most responses with “I haven’t gotten around to it,” while in Oakland this answer was third most common with 25.0%. “I think it costs too much” received the next highest number of responses in Berkeley, and the second highest overall in Oakland. In the Berkeley permit file sample, “I haven’t gotten around to it” and “I don’t know what I need to do” were the most cited answers for not doing retrofit work. Cost didn’t appear to be as significant a factor in deterring retrofits among respondents in Berkeley that received permit fee waivers to do structural work (refer to *TABLE D5 – Why Structural Work Not Done*).

In contrast, the most common answer among the three multifamily sample groups for why the owner acted to retrofit was “I wanted to feel safer or to have my tenants feel safer,” followed by “I am concerned about damaging earthquakes in this building’s neighborhood.” The third most common answer in the random sample of Oakland multi-family building owners was “Other” with 36.8%. Many that answered “other” stated that the structural work was required by code or by a loan inspector, or that the retrofit work was part of a larger remodel or other renovation. However, the third most common answer in both of the Berkeley samples was “I thought it was a good investment, or a good selling point.” In addition, this answer was substantially higher in both Berkeley multifamily surveys compared to the Berkeley single-family survey. In contrast, in Oakland, respondents with multifamily buildings were less likely to have retrofitted because they thought it would be a good investment, compared to single-family homeowners (refer to *TABLE D6 – Why Structural Work Was Done*).

Among respondents in Berkeley’s permit sample and random sample, 31.8% and 35.1% respectively stated they had done retrofit work because of the City’s help, compared to 8.7% from Berkeley’s single-family respondents. It is intriguing that respondents from the Berkeley permit sample were *less* likely to cite the City’s help than respondents from the Berkeley random sample. This is especially ironic since the permit sample was by definition building owners that received a fee waiver to do structural work from the City.

In getting the retrofit work done, a large majority of respondents from the Berkeley permit sample and from the Berkeley random sample hired a contractor with 78.6% and 66.2% respectively taking this action. In Oakland, on the other hand, only 26.1% hired a contractor. Many stated that they both did some work themselves and hired a contractor, and 34.8% stated that they did the work themselves. This number was higher for Oakland than for either of the Berkeley samples. Similarly, hiring or talking to a structural engineer prior to retrofitting the building was much more common in the Berkeley samples – 59.6% among Berkeley respondents that received a fee waiver and 53.8% in the Berkeley random sample – than in Oakland where only 45.8% had taken this action.

Bracing the water heater was by far the most common nonstructural measure taken care of in buildings. Among respondents, 92.7% from Berkeley’s permit sample, 83.9% of Berkeley’s random sample, and 73.9% of Oakland’s random sample stated that this precaution had been taken for their buildings. Bracing the chimney was the second most common nonstructural measure taken. Among the Berkeley permit sample, 29.3% of buildings had braced chimneys,

TABLE D5 - Why Structural Work Was Not Done

Didn't Do Retrofit Work Because	Berkeley							Oakland				Bay Area		
	Single-Family		Multifamily					Single-Family		Multifamily		Single-Family		
	1998 Survey		Permit		Sample		Total		1998 Survey		Sample		1998 Survey	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Don't know anyone who has	15	14.3%	6	15.8%	11	14.3%	17	14.8%	17	16.3%	7	17.5%	275	21.4%
Unsure what to do	43	41.0%	13	34.2%	29	37.7%	42	36.5%	37	35.6%	22	55.0%	550	42.8%
Too hard to do	8	7.6%	1	2.6%	4	5.2%	5	4.3%	4	3.8%	4	10.0%	117	9.1%
Costs too much	39	37.1%	6	15.8%	24	31.2%	30	26.1%	37	35.6%	16	40.0%	485	37.8%
EQ not a problem in neighb.	6	5.7%	1	2.6%	5	6.5%	6	5.2%	4	3.8%	3	7.5%	157	12.2%
Can't get or repay loan	13	12.4%	6	15.8%	9	11.7%	15	13.0%	11	10.6%	3	7.5%	174	13.6%
Bad investment	5	4.8%	0	0.0%	3	3.9%	3	2.6%	8	7.7%	1	2.5%	60	4.7%
Not enough time	37	35.2%	14	36.8%	29	37.7%	43	37.4%	35	33.7%	10	25.0%	346	26.9%
Intimidated by city/county	8	7.6%	3	7.9%	6	7.8%	9	7.8%	11	10.6%	5	12.5%	118	9.2%
Property taxes might go up	5	4.8%	4	10.5%	5	6.5%	9	7.8%	8	7.7%	1	2.5%	83	6.5%
Won't own building very long	6	5.7%	1	2.6%	3	3.9%	4	3.5%	6	5.8%	2	5.0%	90	7.0%
Has earthquake insurance	6	5.7%	0	0.0%	1	1.3%	1	0.9%	15	14.4%	1	2.5%	124	9.7%
Other	29	27.6%	10	26.3%	14	18.2%	24	20.9%	20	19.2%	9	22.5%	261	20.3%
Total (Answered at least one)	105		38		77		115		104		40		1284	

Note 1. The most common responses in the "other" category included:

Didn't know about gas shut-off valve

Structure is seismically sound/no damage yet

Work to be done soon (especially for work needed on chimney)

Not enough money now, but plans to retrofit

Note 2. "Single Family" responses for both cities refers to the single family survey sent to homeowners in summer 1998.

Note 3. Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to at least one of these questions, and not out of the total number of respondents.

TABLE D6 - Why Structural Work Was Done

Did Retrofit Work Because	Berkeley								Oakland				Bay Area	
	Single-Family		Multifamily						Single-Family		Multifamily		Single-Family	
	1998 Survey		Permit		Sample		Total		1998 Survey		Sample		1998 Survey	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Friend did work	17	14.8%	13	11.8%	9	11.7%	22	11.8%	9	12.5%	3	15.8%	67	11.6%
Risk of EQ in area	82	71.3%	74	67.3%	49	63.6%	123	65.8%	45	62.5%	9	47.4%	315	54.5%
Problem when bought	9	7.8%	18	16.4%	14	18.2%	32	17.1%	8	11.1%	5	26.3%	45	7.8%
Letter from contractor	4	3.5%	2	1.8%	2	2.6%	4	2.1%	3	4.2%	0	0.0%	16	2.8%
Good investment	30	26.1%	50	45.5%	30	39.0%	80	42.8%	29	40.3%	3	15.8%	157	27.2%
City/county helped	10	8.7%	35	31.8%	27	35.1%	62	33.2%	0	0.0%	1	5.3%	27	4.7%
Taxes wouldn't go up	6	5.2%	6	5.5%	3	3.9%	9	4.8%	6	8.3%	1	5.3%	40	6.9%
Wouldn't need insurance	6	5.2%	18	16.4%	10	13.0%	28	15.0%	11	15.3%	3	15.8%	52	9.0%
Damage in past EQ	3	2.6%	2	1.8%	1	1.3%	3	1.6%	1	1.4%	0	0.0%	38	6.6%
Discount on insurance	10	8.7%	3	2.7%	0	0.0%	3	1.6%	4	5.6%	1	5.3%	28	4.8%
Saw others' EQ damage	26	22.6%	12	10.9%	14	18.2%	26	13.9%	24	33.3%	2	10.5%	149	25.8%
Scientists spoke of EQ here	33	28.7%	26	23.6%	22	28.6%	48	25.7%	28	38.9%	2	10.5%	153	26.5%
Feel safer/have tenants safer	69	60.0%	77	70.0%	58	75.3%	135	72.2%	47	65.3%	11	57.9%	323	55.9%
Other	18	15.7%	18	16.4%	10	13.0%	28	15.0%	21	29.2%	7	36.8%	160	27.7%
Total (Answered at least one)	115		110		77		187		72		19		578	

Note 1. In the Berkeley permit sample, 26 of the 33 respondents that detailed how the City helped them stated that they received a transfer tax rebate.

This was true of 20 of the 24 respondents in the Berkeley random sample.

Note 2. The one respondent in Oakland that stated that the City helped them retrofit cited the recently implemented Project SAFE.

Note 3. "Single Family" responses for both cities refers to the single family survey sent to homeowners in summer 1998.

Note 4. Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to at least one of these questions, and not out of the total number of respondents.

and this was true of 21.0% and 16.5% respectively of buildings from the Berkeley and Oakland random sample. However, the majority of building owners from these sample groups did not have chimneys. In contrast to the other nonstructural measures, Oakland building owners were more likely to have a gas shut-off valve, with 17.8% of buildings having had one installed, compared to 12.2% of the Berkeley permit sample and 12.6% of the Berkeley random sample. Among respondents from the random samples, we calculated that in 84.6% of Berkeley buildings and 78.1% of Oakland buildings, some nonstructural measures had been taken by the previous or current owner. This was true of 93.5% of respondents from the Berkeley permit sample. It is possible that the reason some respondents that had received Berkeley's permit fee waiver to complete structural work had not taken structural retrofit measures, is they instead opted to take nonstructural measures.

DEMOGRAPHICS AND OTHER RESPONDENT CHARACTERISTICS

Risk perception was highest among respondents in the Berkeley permit sample in which 67.2% believed that there was a very high risk of a future major earthquake in their neighborhood. This was true of 54.1% of Berkeley respondents and 43.3% of Oakland respondents from the random samples. Similarly, respondents from the Berkeley permit file were more likely to have had a friend that did retrofit work, with this being true for 74.3% of respondents, compared to 62.4% and 45.6% from the Berkeley and Oakland random samples respectively. In addition, respondents from the Berkeley permit sample were also more likely to possess earthquake insurance. While this was true of 35.5% of respondents from this sample, it was only true of 21.7% of respondents from the Berkeley random sample and 10.8% from the Oakland random sample.

Oakland respondents were more likely to have food and water at home to help them survive after an earthquake. Of this sample group, 28.1% had food and water for more than four days, compared to 15.8% of respondents from the Berkeley permit sample and 21.0% from the Berkeley random sample. While 92.6% of respondents from the Berkeley permit sample and 83.1% of respondents from the Berkeley random sample graduated from college, this was only true of 56.1% of respondents from the Oakland random sample in which 12.1% had also not finished high school.

The family income between the Berkeley sample groups was quite similar, and was generally higher than the income of respondents from Oakland's random sample. For instance, in Oakland 42.9% of respondents fell into the three highest income categories representing over \$60,000 per year, whereas this was true of 60.3% and 62.3% respectively of the Berkeley permit sample and the Berkeley random sample. Generally, the income levels for the samples were high; this is intuitive since people with higher incomes are better able to afford multifamily residential buildings.

OPEN-ENDED COMMENTS

We gained additional information on the retrofit process from the part of the survey in which respondents were asked for their comments. The most comments received dealt with the need for public funding or loan programs for retrofitting. In the same vein, a comment that was mentioned repeatedly was that retrofit work would cost too much. In a few of these cases in which there was

a belief that the retrofit would be too costly, the owner made a conscious decision to wait for damage from a future earthquake rather than retrofit now.

Although by far the most mentioned comment from the survey sent to single-family homeowners was the high cost and high deductible in earthquake insurance, this was only mentioned by a few multifamily building owners. In addition, no owners mentioned any difficulty in finding contractors, although in the single-family survey this generated the second largest number of comments.

RETROFIT RESULTS

INFLUENCING VARIABLES

We analyzed demographic and housing variables in order to determine if these variables affected whether or not retrofit work had been done. We looked at the relationships between these variables and three different types of retrofit that we defined: the owner acting to at least partially retrofit, an at least partial retrofit of building (by the current or previous owners), and a reasonably complete retrofit of building. The results by variable are discussed below (refer to *TABLE D7 – Acted to at Least Partially Retrofit Building: Influential Variables*, *TABLE D8 – Building Partially Retrofitted: Influential Variables*, and *TABLE D9 – Building with Reasonably Complete Retrofit: Influential Variables*).

Number of Stories in Building

Buildings with fewer stories were more likely to have owners that had acted to at least partially retrofit. This may be true because smaller buildings are often owned by someone that lives on site or nearby who has a larger personal stake in acting to retrofit. However, this correlation was almost the reverse among buildings that had been at least partially retrofitted or that had a reasonably complete retrofit. One-story buildings in these cases were *less* likely to have these types of retrofit work done. These assertions are true except in instances where the sample size for Oakland is exceedingly small.

Because buildings with two or more stories often have a “soft” story of parking, these buildings are particularly vulnerable to earthquakes. As a result, owners with these types of buildings might be more likely to have reasonably complete retrofits in order to counter this problem. Subsequently, this would account for the high percentage of buildings with reasonably complete retrofits among those with two or more stories.

Number of Units in Building

Owners of 2-4 unit residential buildings were more likely to have acted to at least partially retrofit than owners of buildings with more units. This follows the previous assertion that smaller buildings with fewer stories and units are more likely to have owners that have acted to do structural work. This pattern does not appear to be as clear as among buildings that have been at least partially retrofitted or buildings with a reasonably complete retrofit.

TABLE D7 - Acted to at Least Partially Retrofit Building: Influential Variables

Variables	Acted to at Least Partially Retrofit Building					
	Berkeley Permits		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
1 Story	25	89.3%	8	50.0%	1	25.0%
2 Stories	59	78.7%	50	48.5%	16	34.0%
3+ Stories	18	69.2%	11	40.7%	2	11.1%
2-4 Units	89	83.2%	67	55.8%	17	34.0%
5-19 Units	9	81.8%	3	15.8%	3	20.0%
20+ Units	4	100.0%	0	0.0%	1	14.3%
Units over entire garage	5	83.3%	6	66.7%	2	33.3%
Units over partial garage	16	84.2%	10	45.5%	5	55.6%
No units over garage	79	85.0%	55	50.9%	13	24.1%
Bldg built before 1900	7	77.8%	4	50.0%	1	25.0%
Bldg built 1900-1909	20	87.0%	15	51.7%	6	54.5%
Bldg built 1910-1919	15	79.0%	17	58.6%	4	50.0%
Bldg built 1920-1929	28	82.4%	13	56.5%	1	11.1%
Bldg built 1930-1939	4	80.0%	8	88.9%	1	12.5%
Bldg built 1940-1949	13	92.9%	3	50.0%	3	60.0%
Bldg built 1950-1959	7	100.0%	5	45.5%	2	40.0%
Bldg built 1960-1969	5	100.0%	1	8.3%	0	0.0%
Bldg built 1970-1979	0	0.0%	1	20.0%	0	0.0%
Bldg built 1980-1989	0	--	0	--	0	0.0%
Bldg built 1990+	1	50.0%	1	33.3%	1	20.0%
Bldg Renovated	41	83.7%	32	58.2%	10	41.7%
Bldg not Renovated	52	82.5%	37	46.8%	10	24.4%
Nonstruct. Measures	96	83.5%	63	52.1%	19	33.3%
No Nonstruct. Measures	6	2.6%	8	1.9%	2	0.5%
Lived in home in 1989	23	88.5%	16	72.7%	3	50.0%
Lived in California in 1989	64	83.1%	44	45.4%	14	24.6%
Lived Outside CA in 1989	14	77.8%	11	55.0%	3	50.0%
Experienced quake	62	82.7%	39	51.3%	14	31.1%
Never experienced quake	37	84.1%	29	48.3%	5	22.7%
Very high EQ risk	69	86.3%	39	54.2%	11	37.9%
Moderately high EQ risk	29	80.6%	26	49.1%	4	15.4%
Moderately low EQ risk	3	100.0%	2	33.3%	3	27.3%
Very low EQ risk	0	0.0%	1	50.0%	1	100.0%
Friend has acted	69	82.1%	44	53.0%	11	35.5%
No friend acted	25	86.2%	23	46.0%	8	21.6%
Saw ABAG maps	32	86.5%	16	57.1%	3	27.3%
Didn't see ABAG maps	65	81.3%	52	49.1%	17	31.5%
Lives in condo & owns it	19	73.1%	9	39.1%	1	14.3%
Owns bldg & lives in unit	51	85.0%	49	63.6%	9	45.0%
Rents out this condo unit	3	75.0%	0	0.0%	0	0.0%
Rents out all the units	23	95.8%	12	37.5%	9	25.7%
Building is vacant	4	66.7%	1	33.3%	1	25.0%

(Responses continued on next page)

**TABLE D7 - Acted to at Least Partially Retrofit Building: Influential Variables
(continued)**

Variables	Acted to at Least Partially Retrofit Building					
	Berkeley Permits		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
Has EQ insurance	36	83.7%	19	63.3%	2	28.6%
Did have EQ insurance	15	93.8%	17	81.0%	5	62.5%
Never had EQ insurance	50	80.7%	35	40.2%	12	24.0%
Food-water for >4 days	17	89.5%	9	31.0%	4	22.2%
Food-water for 3-4 days	32	94.1%	17	60.7%	3	27.3%
Food-water for 1-2 days	28	77.8%	27	67.5%	6	35.3%
No food-water	24	77.4%	18	43.9%	7	38.9%
No high school	0	--	0	0.0%	4	50.0%
Graduated high school	8	88.9%	9	42.9%	5	23.8%
Graduated college	93	83.0%	60	53.1%	11	29.7%
Income under \$20K	7	87.5%	3	75.0%	1	20.0%
Income \$20-40K	5	62.5%	8	36.4%	9	45.0%
Income \$40-60K	25	96.2%	11	47.8%	2	18.2%
Income \$60-80K	12	85.7%	18	58.1%	2	20.0%
Income \$80-100K	16	84.2%	13	65.0%	2	28.6%
Income over \$100K	23	74.2%	13	43.3%	3	30.0%
First survey	58	57.4%	35	39.8%	7	25.9%
Postcard	17	70.8%	12	40.0%	2	18.2%
Second survey	27	56.3%	24	41.4%	10	28.6%
Oakland postcard	--	--	--	--	2	22.2%

Residential Units Over the Garage

Although there did not appear to be a noticeable correlation between whether the building had residential units over the garage and whether the owner had acted to at least partially retrofit, there was a stronger relationship with regard to the other types of retrofit that we defined. Buildings with no living space above a garage appeared to be slightly more likely to have been at least partially retrofitted or have had a reasonably complete retrofit.

Decade Built

There does not appear to be a strong correlation between the age of the building and whether or not it had been retrofitted, since there is so much variation by decade. However, there appears to be a weak correlation between buildings built before the 1960s and the building having any of the defined types of structural retrofit. The retrofit rate for buildings built in the 1960s and after appears to be lower; however, the response rate for these buildings is also low. Of note is that many of the building age categories show that 100% of these buildings have been at least partially retrofitted.

TABLE D8 - Building Partially Retrofitted: Influential Variables

Variables	Building Partially Retrofitted					
	Berkeley Permits		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
1 Story	25	89.3%	9	56.3%	4	100.0%
2 Stories	68	90.7%	73	70.9%	27	57.4%
3+ Stories	24	92.3%	17	63.0%	12	66.7%
2-4 Units	102	95.3%	96	80.0%	35	70.0%
5-19 Units	11	100.0%	5	26.3%	7	46.7%
20+ Units	4	100.0%	0	0.0%	5	71.4%
Units over entire garage	6	100.0%	6	66.7%	5	83.3%
Units over partial garage	18	94.7%	12	54.5%	6	66.7%
No units over garage	91	97.8%	83	76.9%	35	64.8%
Bldg built before 1900	9	100.0%	6	75.0%	2	50.0%
Bldg built 1900-1909	23	100.0%	26	89.7%	8	72.7%
Bldg built 1910-1919	19	100.0%	22	75.9%	7	87.5%
Bldg built 1920-1929	34	100.0%	21	91.3%	6	66.7%
Bldg built 1930-1939	4	80.0%	9	100.0%	6	75.0%
Bldg built 1940-1949	13	92.9%	4	66.7%	4	80.0%
Bldg built 1950-1959	7	100.0%	5	45.5%	2	40.0%
Bldg built 1960-1969	5	100.0%	1	8.3%	0	0.0%
Bldg built 1970-1979	0	0.0%	1	20.0%	2	50.0%
Bldg built 1980-1989	0	0.0%	0	--	2	100.0%
Bldg built 1990+	1	50.0%	1	33.3%	2	40.0%
Bldg Renovated	47	95.9%	47	85.5%	21	87.5%
Bldg not Renovated	61	96.8%	50	63.3%	22	53.7%
Nonstruct. Measures	110	95.7%	92	76.0%	38	66.7%
No Nonstruct. Measures	7	3.0%	10	2.4%	9	2.3%
Lived in home in 1989	26	100.0%	18	81.8%	5	83.3%
Lived in California in 1989	74	96.1%	70	72.2%	35	61.4%
Lived Outside CA in 1989	16	88.9%	14	70.0%	5	83.3%
Experienced quake	71	94.7%	60	78.9%	31	68.9%
Never experienced quake	43	97.7%	39	65.0%	12	54.5%
Very high EQ risk	78	97.5%	57	79.2%	22	75.9%
Moderately high EQ risk	33	91.7%	35	66.0%	17	65.4%
Moderately low EQ risk	3	100.0%	5	83.3%	4	36.4%
Very low EQ risk	0	0.0%	1	50.0%	1	100.0%
Friend has acted	80	95.2%	62	74.7%	19	61.3%
No friend acted	29	100.0%	35	70.0%	25	67.6%
Saw ABAG maps	36	97.3%	23	82.1%	8	72.7%
Didn't see ABAG maps	76	95.0%	76	71.7%	34	63.0%
Lives in condo & owns it	23	88.5%	17	73.9%	5	71.4%
Owns bldg & lives in unit	59	98.3%	64	83.1%	15	75.0%
Rents out this condo unit	3	75.0%	0	0.0%	1	100.0%
Rents out all the units	24	100.0%	19	59.4%	22	62.9%
Building is vacant	6	100.0%	2	66.7%	1	25.0%

(Responses continued on next page)

TABLE D8 - Building Partially Retrofitted: Influential Variables (continued)

Variables	Building Partially Retrofitted					
	Berkeley Permits		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
Has EQ insurance	41	95.3%	26	86.7%	5	71.4%
Did have EQ insurance	15	93.8%	17	81.0%	5	62.5%
Never had EQ insurance	60	96.8%	59	67.8%	33	66.0%
Food-water for >4 days	18	94.7%	18	62.1%	13	72.2%
Food-water for 3-4 days	33	97.1%	23	82.1%	7	63.6%
Food-water for 1-2 days	35	97.2%	35	87.5%	10	58.8%
No food-water	30	96.8%	26	63.4%	12	66.7%
No high school	0	0.0%	0	0.0%	6	75.0%
Graduated high school	9	100.0%	14	66.7%	12	57.1%
Graduated college	107	95.5%	86	76.1%	26	70.3%
Income under \$20K	8	100.0%	3	75.0%	4	80.0%
Income \$20-40K	7	87.5%	12	54.5%	16	80.0%
Income \$40-60K	25	96.2%	17	73.9%	7	63.6%
Income \$60-80K	14	100.0%	26	83.9%	6	60.0%
Income \$80-100K	19	100.0%	16	80.0%	3	42.9%
Income over \$100K	29	93.5%	23	76.7%	6	60.0%
First survey	65	64.4%	53	60.2%	18	66.7%
Postcard	18	75.0%	15	50.0%	5	45.5%
Second survey	34	70.8%	34	58.6%	20	57.1%
Oakland postcard	--	--	--	--	4	44.4%

Renovation of Building

Among the Berkeley and Oakland random samples there was a clear relationship between buildings that have been renovated and retrofit work done on the building. This correlation was particularly strong among buildings with at least partial retrofits which were 22.2%-33.8% more likely to have had this retrofit work done if there had been a major renovation. Because building owners are often informed of structural work to be done during the course of a renovation, this seems logical. However, for owners that had received permit fee waivers from the City of Berkeley to do structural work, there did not appear to be a relationship between building renovation and any of the defined types of retrofit.

Nonstructural Measures

Buildings in which nonstructural measures had also been taken were more likely to have any of the defined types of retrofit than buildings in which no nonstructural measures had been taken. Among the three survey samples, owners of buildings in which nonstructural measures had been taken were 32.8%-80.9% more likely to have acted to at least partially retrofit the building. This is logical because building owners that structurally prepare their buildings for earthquakes would be likely to also take nonstructural preparations in their buildings.

TABLE D9 - Building with Reasonably Complete Retrofit: Influential Variables

Variables	Building with Reasonably Complete Retrofit					
	Berkeley Permits		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
1 Story	17	60.7%	3	18.8%	4	100.0%
2 Stories	59	78.7%	56	54.4%	22	46.8%
3+ Stories	19	73.1%	14	51.9%	7	38.9%
2-4 Units	83	77.6%	70	58.3%	25	50.0%
5-19 Units	10	90.9%	5	26.3%	5	33.3%
20+ Units	2	50.0%	0	0.0%	3	42.9%
Units over entire garage	2	33.3%	3	33.3%	5	83.3%
Units over partial garage	12	63.2%	7	31.8%	4	44.4%
No units over garage	79	84.9%	65	60.2%	24	44.4%
Bldg built before 1900	7	77.8%	4	50.0%	0	0.0%
Bldg built 1900-1909	23	100.0%	22	75.9%	6	54.5%
Bldg built 1910-1919	16	84.2%	19	65.5%	6	75.0%
Bldg built 1920-1929	27	79.4%	12	52.2%	2	22.2%
Bldg built 1930-1939	2	40.0%	4	44.4%	3	37.5%
Bldg built 1940-1949	9	64.3%	2	33.3%	1	20.0%
Bldg built 1950-1959	4	57.1%	4	36.4%	4	80.0%
Bldg built 1960-1969	4	80.0%	3	25.0%	1	100.0%
Bldg built 1970-1979	1	100.0%	2	40.0%	2	50.0%
Bldg built 1980-1989	0	0.0%	0	--	2	100.0%
Bldg built 1990+	1	50.0%	1	33.3%	2	40.0%
Bldg Renovated	37	75.5%	33	60.0%	14	58.3%
Bldg not Renovated	49	77.8%	40	50.6%	16	39.0%
Nonstruct. Measures	89	77.4%	67	55.4%	29	50.9%
No Nonstruct. Measures	6	2.6%	9	2.1%	4	1.0%
Lived in home in 1989	22	84.6%	13	59.1%	3	50.0%
Lived in California in 1989	61	79.2%	52	53.6%	23	40.4%
Lived Outside CA in 1989	12	66.7%	11	55.0%	6	100.0%
Experienced quake	58	77.3%	49	64.5%	20	44.4%
Never experienced quake	36	81.8%	26	43.3%	11	50.0%
Very high EQ risk	67	83.8%	44	61.1%	16	55.2%
Moderately high EQ risk	25	69.4%	25	47.2%	9	34.6%
Moderately low EQ risk	3	100.0%	2	33.3%	6	54.5%
Very low EQ risk	4	0.0%	1	50.0%	1	100.0%
Friend has acted	68	81.0%	49	59.0%	14	45.2%
No friend acted	21	72.4%	23	46.0%	17	45.9%
Saw ABAG maps	28	75.7%	20	71.4%	6	54.5%
Didn't see ABAG maps	65	81.3%	54	50.9%	25	46.3%
Lives in condo & owns it	18	69.2%	15	65.2%	4	57.1%
Owns bldg & lives in unit	49	81.7%	45	58.4%	11	55.0%
Rents out this condo unit	3	75.0%	0	0.0%	1	100.0%
Rents out all the units	20	83.3%	13	40.6%	13	37.1%
Building is vacant	5	83.3%	2	66.7%	1	25.0%

(Responses continued on next page)

**TABLE D9 - Building with Reasonably Complete Retrofit: Influential Variables
(continued)**

Variables	Building with Reasonably Complete Retrofit					
	Berkeley Permits		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
Has EQ insurance	33	76.7%	20	66.7%	5	71.4%
Did have EQ insurance	11	68.8%	15	71.4%	3	37.5%
Never had EQ insurance	51	82.3%	41	47.1%	21	42.0%
Food-water for >4 days	15	78.9%	12	41.4%	7	38.9%
Food-water for 3-4 days	29	85.3%	14	50.0%	3	27.3%
Food-water for 1-2 days	27	75.0%	26	65.0%	7	41.2%
No food-water	24	77.4%	24	58.5%	11	61.1%
No high school	0	0.0%	1	50.0%	3	37.5%
Graduated high school	7	77.8%	8	38.1%	8	38.1%
Graduated college	88	78.6%	65	57.5%	19	51.4%
Income under \$20K	6	75.0%	1	25.0%	2	40.0%
Income \$20-40K	6	75.0%	8	36.4%	10	50.0%
Income \$40-60K	18	69.2%	12	52.2%	7	63.6%
Income \$60-80K	11	78.6%	20	64.5%	5	50.0%
Income \$80-100K	17	89.5%	14	70.0%	1	14.3%
Income over \$100K	24	77.4%	16	53.3%	3	30.0%
First survey	56	55.4%	39	44.3%	11	40.7%
Postcard	13	54.2%	11	36.7%	3	27.3%
Second survey	26	54.2%	26	44.8%	16	45.7%
Oakland postcard	--	--	--	--	3	33.3%

Where Lived in 1989

Respondents that lived in their current home in 1989 at the time of the Loma Prieta earthquake were more likely to own a building that had been structurally retrofitted. The only time this was not the case was when one of the samples was too small for the results to be valid.

Experienced an Earthquake

Among the Berkeley and Oakland random samples, building owners that had experienced a major earthquake appeared to be more likely to own a structurally retrofitted building. This was true in all cases except for those with reasonably complete building retrofits in the Oakland sample, which had a smaller sample size than the others examined. On the other hand, among respondents from the sample group that received permit fee waivers from the City of Berkeley, those that had experienced a major earthquake were *less* likely to own a building with any of the defined types of retrofit. It's possible that this sample group, which is probably more attune to earthquakes as evidenced by their inclusion in the sample group, might not perceive the Loma Prieta earthquake as a major earthquake. This group might consider "experiencing a major earthquake" to be a major earthquake on the Hayward fault, which will be closer to them and will cause more damage.

Risk Perception

The building owner's perception of risk appeared to be correlated with whether or not the building had been retrofitted. Across all three samples and definitions of retrofit, respondents with a very high perception of risk were 5.1%-22.5% more likely to own a building with some type of retrofit work. This relationship was difficult to discern among respondents with moderately low to very low risk perception, simply because of the small sample sizes of these groups.

In addition, we found that risk perception was linked to educational attainment. Among respondents that had graduated from college, 35.0% perceived a moderately high earthquake risk, while 60.7% perceived very high earthquake risk. This represents a difference of 25.7% between risk categories. Furthermore, among respondents that had only graduated from high school, only 38.0% perceived very high earthquake risk compared to 44.0% who perceived a moderately high earthquake risk. Although we combined the three survey samples in order to more clearly see trends in the data, there was still not a large enough sample among respondents that had not graduated from high school to make valid conclusions for this group (refer to *TABLE D10 – Educational Attainment and Risk Perception*).

TABLE D10 - Educational Attainment and Risk Perception

Risk Perception	Educational Attainment					
	Didn't Finish High School		Graduated High School		Graduated College	
	Number	Percent	Number	Percent	Number	Percent
Very High EQ Risk	4	50.0%	19	38.0%	156	60.7%
Mod. High EQ Risk	1	12.5%	22	44.0%	90	35.0%
Mod. Low EQ Risk	3	37.5%	6	12.0%	11	4.3%
Very Low EQ Risk	0	0.0%	3	6.0%	0	0.0%

Note 1. The samples were added together in order to see trends more clearly. Because there was little sampling of respondents that had not finished high school, it was necessary to group these samples together in order to make statistically valid conclusions.

Knows Someone Who Has Acted

Generally, respondents who knew someone (such as a friend or neighbor) who had retrofitted were more likely to own a building with any of the defined types of retrofit. Among respondents from the Berkeley and Oakland random samples, those knowing someone who had acted were 7.0%-13.9% more likely to have acted to at least partially retrofit the building. However, this appeared to be a relatively weak relationship, since this didn't appear to be the case among owners with buildings in Oakland that had been at least partially retrofitted. In addition, within the sample that had their permit fees waived in Berkeley, these respondents overall appeared to be less likely to retrofit when they knew someone who acted to retrofit.

ABAG Maps

For the most part, respondents that had seen ABAG's earthquake shaking hazard maps were more likely to own a building with some type of retrofit work. However, the opposite was the

case among respondents from the Berkeley permit sample whose buildings had reasonably complete retrofits, as well as among Oakland respondents who acted to at least partially retrofit. However, in the case of the latter, this discrepancy can be traced to a low sample size of people that had seen the ABAG maps.

Owners and Renters

Respondents in the Berkeley and Oakland random samples that lived in one of the units in the specified building (including condominiums) were more likely to have acted to at least partially retrofit the building, and their building was more likely to be a partial or reasonably complete retrofit. Although there were many respondents who lived in a condominium that they owned, there were very few respondents who rented out condominium units. Therefore, no statistically valid conclusions could be made for this sample group. Respondents from the Berkeley and Oakland random samples that owned the entire residential building and lived in one of the units (not including condominiums) were 19.3%-26.1% more likely to have acted to at least partially retrofit the building than owners that rented out all the units in the building. Curiously this trend is reversed among the Berkeley permit sample. In this sample, respondents renting out all the units were more likely to own a building with some type of retrofit work than those owning the building and living in one of the units.

Earthquake Insurance

There did not appear to be a particular response as to whether the respondent had earthquake insurance that had a relationship with any of the defined types of retrofit. Overall, respondents in all samples were slightly more likely to have a building that was retrofitted in some way if they previously or currently owned earthquake insurance. Respondents from the Berkeley permit sample and the Berkeley random sample that used to have earthquake insurance were respectively 10.1% and 17.7% more likely to have acted to at least partially retrofit their buildings. However, generally the responses varied to such an extent between samples and between types of building retrofit that a definitive relationship cannot be assumed.

Food and Water

Rates for different types of retrofit varied tremendously over the three samples for having food and water in the event of an earthquake. As a result, there appeared to be no correlation between this variable and retrofit rates.

Educational Attainment

Generally, respondents throughout all three samples that had graduated from college were more likely to own a building that had some type of previously defined retrofit work than those that had only graduated from high school. Respondents from the Berkeley and Oakland random samples that had graduated from college were respectively 5.9% and 10.2% more likely to have acted to at least partially retrofit their building than respondents that had only graduated from high school. The only time in the calculations when those graduating from college did not have a higher rate of any type was when the sample size was too small with only ten or fewer

respondents. In fact, the sample size of respondents that had not graduated from high school was consistently too small to make any valid conclusions.

Household Income

There was not a discernable relationship between the building owner's household income and the building being retrofitted in any of the defined ways. Part of the reason that it is difficult to find a correlation or lack thereof is because of the small sample sizes in some of the income categories – particularly in Oakland.

REASONS FOR RETROFIT WORK

We believed that small and large multifamily buildings might vary greatly with regard to the owner's concern of potential earthquakes. One reason for this belief was based on larger multifamily buildings having “soft” story parking; living units above this “soft” story parking are often particularly vulnerable to earthquakes. In addition, we hypothesized that owner-occupants might have different motivations for retrofitting – perhaps more life safety oriented – than owners that rent out the entire building. As a result, we looked at the reasons for structural work among respondents in different size buildings, and among respondents that are owner-occupants and those that are not.

Number Of Units in Building

Overall, the reasons for retrofitting varied little by the number of units in the building. However, completing retrofit work to feel safer or to have the tenant feel safer was 29.8% higher among owners of 5-19 unit buildings compared to owners of 2-4 units, with 92.9% of 5-19 unit building owners answering this question. This was astounding – particularly because we expected that owner-occupants would be more likely to retrofit because their personal life safety would be at stake. One way that 2-4 unit buildings differ from those that are 5-19 units is in the type of construction – particularly in the way that many larger buildings have “soft” story of parking. Therefore, it is possible that safety is more an issue among owners of larger multifamily buildings because of the perception of buildings with “soft” story parking being unsafe in an earthquake with a higher life safety.

The other reasons to do retrofit work that differed between small and large multifamily buildings also may have been related to the issue of “soft” story buildings. Respondents with 5-19 unit buildings were 6.4% more likely to have retrofitted because they knew of a problem at the time of the building's purchase. This problem might have been that there was a “soft” story that needed structural strengthening. Similarly, the perception of risk is again evident in respondents with 5-19 unit buildings being 24.6% more likely than 2-4 unit building owners to have retrofitted because of the threat of a damaging earthquake in the building's neighborhood risk (refer to *TABLE D11 – Reasons Retrofit Work Done and Number of Units in Building*).

TABLE D11 - Reasons Retrofit Work Done and Number of Units in Building

Did Retrofit Work Because	Number of Units in Building					
	2-4 Units		5-19 Units		20+ Units	
	Number	Percent	Number	Percent	Number	Percent
Friend did work	20	10.7%	2	14.3%	0	0.0%
Risk of EQ in area	101	54.0%	11	78.6%	2	50.0%
Problem when bought	28	15.0%	3	21.4%	0	0.0%
Letter from contractor	4	2.1%	0	0.0%	0	0.0%
Good investment	60	32.1%	5	35.7%	0	0.0%
City/county helped	53	28.3%	4	28.6%	0	0.0%
Taxes wouldn't go up	7	3.7%	0	0.0%	0	0.0%
Wouldn't need insurance	22	11.8%	2	14.3%	1	25.0%
Damage in past EQ	2	1.1%	0	0.0%	0	0.0%
Discount on insurance	0	0.0%	1	7.1%	0	0.0%
Saw others' EQ damage	28	15.0%	3	21.4%	1	25.0%
Scientists spoke of EQ here	41	21.9%	5	35.7%	0	0.0%
Feel safer/have tenants safer	118	63.1%	13	92.9%	0	0.0%
Other	25	13.4%	3	21.4%	1	25.0%
Total (Answered at least one)	187		14		4	

Note 1. The samples were added together in order to see trends more clearly. Because there was little sampling of 5+ unit buildings, it was necessary to group these samples together in order to make statistically valid conclusions.

Note 2. Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to at least one of these questions, and not out of the total number of respondents.

Where the Owner Lives

The reasons for retrofitting that change the most by where the owner lives are the owner wouldn't need insurance and the owner knew there was a structural problem at the time of purchase. These two motivations for retrofitting are much more common among owner-occupants and among those living in the same city as the building than owners that live elsewhere in the Bay Area.

Other than these two motivations for retrofitting, there was very little differentiation between answers based on where the owner lives. Most significantly, it appeared as though feeling safer or having tenants feel safer was equally important for owner-occupants as it was for owners that lived elsewhere in the city. As found for motivations to retrofit for different size buildings, it appears as though tenant safety is equally or even more important to the owner as personal safety (refer to *TABLE D12 – Reasons Retrofit Work Done and Number of Units in Building*).

TABLE D12 - Reasons Retrofit Work Done and Number of Units in Building

Did Retrofit Work Because	Where Owner Lives									
	In Unit in Building		In Same City		In Bay Area		In California		Outside of Calif.	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Friend did work	16	11.3%	6	17.1%	3	11.5%	0	0.0%	0	0.0%
Risk of EQ in area	92	64.8%	22	62.9%	15	57.7%	2	100.0%	1	100.0%
Problem when bought	29	20.4%	6	17.1%	2	7.7%	0	0.0%	0	0.0%
Letter from contractor	4	2.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Good investment	64	45.1%	8	22.9%	11	42.3%	0	0.0%	0	0.0%
City/county helped	44	31.0%	10	28.6%	8	30.8%	1	50.0%	0	0.0%
Taxes wouldn't go up	8	5.6%	1	2.9%	1	3.8%	0	0.0%	0	0.0%
Wouldn't need insurance	25	17.6%	5	14.3%	1	3.8%	0	0.0%	0	0.0%
Damage in past EQ	1	0.7%	1	2.9%	0	0.0%	0	0.0%	1	100.0%
Discount on insurance	3	2.1%	0	0.0%	1	3.8%	0	0.0%	0	0.0%
Saw others' EQ damage	21	14.8%	2	5.7%	5	19.2%	0	0.0%	0	0.0%
Scientists spoke of EQ here	34	23.9%	10	28.6%	6	23.1%	0	0.0%	0	0.0%
Feel safer/have tenants safer	103	72.5%	26	74.3%	14	53.8%	2	100.0%	1	100.0%
Other	24	16.9%	6	17.1%	4	15.4%	1	50.0%	0	0.0%
Total (Answered at least one)	142		35		26		2		1	

Note 1. The samples were added together in order to see trends more clearly. Because there was little sampling of buildings outside the city in which the owner lived, it was necessary to group these samples together in order to make statistically valid conclusions.

Note 2. "Lives in Same City" does not include buildings which fell into the previous "Lives in Unit in Building" category. Similarly, "Lives in Bay Area" does not include buildings which fell into the previous categories, "Lives in Unit in Same City" or "Lives in Unit in Building," and so on.

Note 3. The Bay Area was defined as the nine-county Bay Area, which includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties.

Note 4. Information on where the owner lives was taken from MetroScan data, not self-reported survey data. This is because the self-reported data does not always agree with the MetroScan data (which was needed to calculate the total universe of respondents).

Note 5. Percentages do not equal 100% because respondents could check more than one answer. The percentages are only out of the universe of those responding to at least one of these questions, and not out of the total number of respondents.

TENANT LIABILITY

One common assumption is that concern for safety of a building occupant is greater for an owner-occupant than for an owner renting the housing units. Based on the survey responses the opposite appeared to be true. Among single-family homeowners in Berkeley, 60.0% stated that they did the retrofit work so that they would feel safer. However, 10-15% more Berkeley multifamily building owners stated that they did the work to feel safer or to have their tenants feel safer. As a result, we believed that perhaps liability or fear of liability was a contributing factor (refer to *TABLE D13 – Retrofit Work Done Because of Personal or Tenant Safety*).

TABLE D13 - Retrofit Work Done Because of Personal or Tenant Safety

Did Retrofit Work Because	Berkeley						Oakland		Bay Area
	Single-Family	Multifamily					Single-Family	Multifamily	Single-Family
	1998 Survey	Permit	Sample	Total			1998 Survey	Sample	1998 Survey
	# %	# %	# %	# %	# %	# %	# %	# %	# %
Feel safer/have tenants safer	69 60.0%	77 70.0%	58 75.3%	135 72.2%	47 65.3%	11 57.9%	323 55.9%		
Total (Answered at least one)	115	110	77	187	72	19	578		

Note 1. Other options to this survey question are not included. "Total" refers to the universe of those responding to at least one of these questions, and not out of the total number of respondents.

We called 16 owners of multifamily buildings who had responded to the survey and had stated that one of the reasons they had retrofitted was because of personal or tenant safety. We made sure that the selection of these buildings was at random and equally distributed among the sample groups. In addition, we attempted to select different size buildings, and select buildings in which there were owner-occupants and ones in which there were not.

None of the 16 multifamily building owners mentioned tenant liability as a reason for the retrofit work when asked to elaborate on their answer of safety in the survey. When they were asked plainly whether or not they had even considered tenant liability in their decision to retrofit, only one owner stated that tenant liability was an issue. However, this owner stated that the structural work had primarily been done for life safety reasons; as a hospital worker, he simply wanted to make places safe.

Many of the owners of small multifamily buildings lived on the site. In many cases family members or business partners lived in other units, the owner lived in several units, or the work was done before the owner ever began renting out the units. In these cases personal safety seemed to be the reason the work was done – not tenant safety. However, for other owners of small multifamily buildings – both owner-occupied and renter-occupied – they felt it was their responsibility to make their tenants safe.

Among some of the larger multifamily buildings in which the owner did not live on site, the reason the structural work was done seemed to be predominantly investment-oriented and only partially based on life safety reasons.

AMOUNT SPENT ON RETROFIT

We looked at the amount spent on retrofit work for different size multifamily buildings. With the average amount spent on retrofit work per unit in the thousands of dollars, these results indicate that owners had substantially retrofitted their buildings. The average retrofit cost per unit for building categories with at least five respondents seems to be \$3,000 to \$5,300. It appears as though less money was spent per unit on the largest multifamily buildings. However, in these larger multifamily buildings the sample size of these size buildings was not large enough to be

statistically valid (refer to *TABLE D14 – Amount Spent on Retrofit by Number of Units in Building*).

TABLE D14 - Amount Spent on Retrofit by Number of Units in Building

Number of Units in Building	Sample Source								
	Berkeley Permits			Berkeley Sample			Oakland Sample		
	Number Returned	Average Amount Spent on Building	Average Amount Spent per Unit	Number Returned	Average Amount Spent on Building	Average Amount Spent per Unit	Number Returned	Average Amount Spent on Building	Average Amount Spent per Unit
2 Units	59	\$9,911	\$4,956	35	\$9,897	\$4,949	6	\$10,583	\$5,292
3 Units	10	\$10,160	\$3,387	10	\$14,630	\$4,877	4	\$23,750	\$7,917
4 Units	10	\$13,366	\$3,342	11	\$12,096	\$3,024	1	\$3,000	\$750
5-19 Units	6	\$47,417	\$4,822	2	\$6,750	\$1,125	2	\$11,000	\$1,100
20+ Units	2	\$13,500	\$397	0	--	--	1	\$10,000	\$303

EFFECTIVENESS OF BERKELEY'S RETROFIT PROGRAM

DATE RETROFIT WORK DONE

We looked at the date retrofit work was done in Berkeley and Oakland in the 1990s, particularly because we wanted to see the effects the Berkeley retrofit program and the Northridge earthquake had on when retrofits were completed. The percentage of respondents retrofitting jumped 9.4% and 17.9% between 1992-1993 and 1994-1995 for the Berkeley permit sample and the Berkeley random sample respectively. It is apparent that something happened to speed up retrofits in Berkeley in 1994 and 1995, and has gone on to peak in the last couple of years. It is possible that the Berkeley retrofit program, which started in 1992, began to have a significant impact in 1994-1995. In addition, another reason for this rise in retrofit rates in 1994-1995 might be due to the 1994 Northridge earthquake. Multifamily building owners might have seen coverage of the destruction of multifamily buildings, particularly those with “soft” story parking (refer to *TABLE D15 – Date Retrofit Work Done in 1990s*).

TABLE D15 - Date Retrofit Work Done in 1990s

Date of Retrofit Work	Sample Source					
	Berkeley Permit File		Berkeley Sample		Oakland Sample	
	Number	Percent	Number	Percent	Number	Percent
1990-1991	1	0.9%	7	10.4%	6	31.6%
1992-1993	1	0.9%	3	4.5%	3	15.8%
1994-1995	11	10.3%	15	22.4%	0	0.0%
1996-1997	47	43.9%	15	22.4%	3	15.8%
1998-1999	47	43.9%	27	40.3%	7	36.8%

There are not enough data on when retrofit work was done in Oakland in the 1990s, and as a result there does not appear to be a clear trend.

TIME AFTER PURCHASE UNTIL RETROFITTED

We believed that if Berkeley's retrofit program was effective, there would be an increased rate of building owners acting to retrofit – particularly within the first year of purchase. Therefore, we analyzed the amount of time it took building owners to retrofit after purchasing multifamily buildings by subtracting the first date of retrofit work from the deed transfer date that we received from MetroScan. We also looked specifically at the 2-4 unit buildings from the Berkeley random sample. Buildings of 2-4 units were officially the only ones of the multifamily residential buildings to qualify for the transfer tax rebate. This sub-sample would have received the most potential benefits of the Berkeley retrofit program, so it is essential to look at this group in order to determine the effects of the program.

For both Berkeley samples, the percentage of respondents acting to at least partially retrofit their buildings within the first year of purchase significantly increased among people that purchased their buildings after 1991. In the Berkeley permit sample, *no* respondents had acted to at least partially retrofit within the first year of purchase among those purchasing buildings in or before 1991. This is compared to 70.2% retrofitting within the first year among those purchasing buildings after 1991. Because the selection of this sample focuses on multifamily building owners that had received fee permit waivers after 1991, the sample selection is primarily responsible for this difference (refer to *TABLE D16 – Amount of Time it Took Owner to Retrofit After Purchase of Building*).

TABLE D16 - Amount of Time it Took Owner to Retrofit After Purchase of Building

Sample Source	Percentage Acting to Retrofit Building in 1 Year or Less After Purchase (Number Acting / Number of Respondents)		Ratio of Percentage Acting to Retrofit Within 1 Year of Building Purchase Before vs. After 1991	Average Number of Years Respondents Took to Begin Retrofit After Purchase (Number of Respondents)		Ratio of Number of Years Before Acting After Purchase for Buildings Purchased Before vs. After 1991
	Purchased in 1991 or earlier	Purchased after 1991		Purchased in 1991 or earlier	Purchased after 1991	
Berkeley Permits	(0/17) 0.0%	(59/84) 70.2%	--	(17) 13.2	(65) 0.7	18.2
Berkeley Sample	(6/14) 42.9%	(34/49) 69.4%	1.6	(11) 2.4	(41) 0.8	2.9
Berkeley Sample (2-4 Units)	(6/14) 42.9%	(32/46) 69.6%	2.4	(11) 2.4	(38) 0.8	2.9
Oakland Sample	(2/3) 66.7%	(5/13) 38.5%	0.6	(3) 1.0	(10) 1.5	0.7

However, among respondents in the Berkeley random sample, the percentage of owners acting to at least partially retrofit within the first year of purchase was 42.9% for owners purchasing buildings in 1991 or before, and 69.4% for those who purchased buildings after 1991. Therefore, among buildings purchased after 1991 the percentage of those acting to at least partially retrofit within the first year of purchase was 1.6 times the percentage of respondents in or before 1991. Furthermore, among owners of 2-4 unit buildings in the Berkeley random sample, 28.6% had acted to at least partially retrofit within the first year of purchase, compared to 69.6% for those purchasing buildings after 1991. Consequently, according this data, Berkeley owners that purchased their 2-4 unit buildings after 1991 were 2.4 times as likely to retrofit within the first year of purchase as owners that purchased their buildings in or before 1991.

In the Oakland sample there was too small a sample of respondents acting to retrofit in or before 1991. However, the sample was substantially larger for those retrofitting after 1991, with 38.5% retrofitting within the first year of purchase. This number was 31% lower than that for the Berkeley overall and 2-4 unit building samples.

Respondents purchasing multifamily buildings after 1991 from both of the Berkeley samples appeared to have decreased the average number of years it took them to retrofit after purchasing the building. This was especially true of the Berkeley permit sample in which respondents who purchased their building in 1991 or before took on average 13.2 years to retrofit, compared to those who purchased their building after 1991 who took an astoundingly low 0.7 years on average to retrofit. This would indicate that Berkeley owners who purchased their buildings after 1991 were 18.2 times faster in retrofitting than those purchasing their buildings in or before 1991. However, as for the percentages acting to retrofit their building within the first year of purchase for the Berkeley permit sample, these numbers are probably skewed because of the sample selection.

This trend also appears in the overall Berkeley random sample and the Berkeley sample of 2-4 unit buildings (the numbers of these two samples are identical), and is probably closer to the actual increase in the time to begin retrofitting among the City's multifamily building owners. While those in Berkeley who purchased buildings in or before 1991 took on average 2.4 years to retrofit, those purchasing buildings after 1991 took only 0.8 years on average to begin retrofitting. Thus, Berkeley respondents who purchased their buildings after 1991 were 2.9 times faster to begin retrofitting than those purchasing buildings in or before 1991.

Again, in Oakland, the number of respondents that had purchased their buildings in 1991 or before was too small to calculate the average number of years they took to act to at least partially retrofit. However, this number was large enough among respondents purchasing their buildings after 1991 to make comparisons. In Oakland, respondents who had purchased their buildings after 1991 took on average 1.5 years to begin retrofitting - 0.7 years more than for either of the Berkeley random samples.

A large portion of the increase in time for Berkeley multifamily building owners to retrofit may be attributed to Berkeley's retrofit program. However, other factors may be involved such as increased risk perception after the Loma Prieta and Northridge earthquakes, changes in State of California disclosure requirements in 1992, and unique demographics in Berkeley.

BERKELEY'S PROGRAM EFFECTIVENESS CONCLUSIONS

Of survey respondents that had permit fees waived by the City of Berkeley to do retrofit work, a surprisingly small 31.8% mentioned that they had retrofitted because of help from the City. This percentage was *lower* than the 35.1% of MetroScan's random sample of owners of multifamily buildings. In addition, *none* of the respondents answering how the City helped them mentioned the permit fee waiver – even among the respondents from Berkeley's list of addresses that received the permit fee waiver. Instead, the majority of those stating that the City had helped cited the transfer tax rebate. This rebate was specifically mentioned by 78.8% of respondents from the Berkeley permit sample and 83.3% of the respondents from the Berkeley random

sample that cited City assistance. One reason for this might be that unlike the transfer tax program, which is put forward to the public primarily as a part of the real estate closing process, the waiving of permit fees for seismic work is not publicized in any way. As a result, property owners who receive the fee waiver are those who have already decided to retrofit, and find out about this windfall when they go the city department for assistance. ***The Berkeley program of waiving permit fees does not encourage retrofitting by property owners.***

Approximately 4.0 times as many multifamily owners (from the random sample) in Berkeley cited the City's assistance as single-family homeowners in Berkeley. In addition, several other financial factors, such as "good investment" and "I wouldn't need earthquake insurance," were significantly higher among multifamily owners in that city versus owners of single-family homes. Among Berkeley sample respondents who acted to at least partially retrofit and who purchased their buildings after 1991, 43% cited the City's program as a reason that they did the work, as opposed to 15% of the single-family housing owners citing this program. ***Thus, the financial incentive of the property transfer tax has been an effective means of promoting retrofits among multifamily residential building owners in Berkeley, and is potentially responsible for a 43% increase in the number of owners retrofitting their buildings.***

In Oakland, the one person who stated that they received City help in their retrofit cited Project SAFE. This is a FEMA Project Impact pilot project that collaborates with the City to provide grants and low interest loans to homeowners as incentives to encourage them to structurally strengthen their buildings. This program was initiated in January 1998 so it has not yet had a widespread effect in encouraging people to retrofit, although it has a lot of potential as an incentive package for building owners. For further detail on Project SAFE refer to Technical Appendix C.

CONCLUSIONS

FACTORS MOST INFLUENCING RETROFIT

Many of the demographics and housing variables were found to be correlated with whether the respondent had acted to at least partially retrofit. The factors which were most influential as to whether respondents had acted are as follows and in no specific order:

- ◆ 1-story building
- ◆ 2-4 unit building
- ◆ Building constructed before 1960
- ◆ Building has been renovated
- ◆ Nonstructural measures have been taken
- ◆ Lived in current home in 1989
- ◆ Perception of very high earthquake risk
- ◆ Has seen ABAG maps
- ◆ Owner-occupants
- ◆ Used to have earthquake insurance
- ◆ Graduated from college

REASONS STRUCTURAL WORK DONE OR NOT DONE

Reasons Structural Work Done

The two most common responses for the Berkeley and Oakland samples as to why the respondent had completed structural work are below in order of importance:

- ◆ I wanted to feel safer or to have my tenants feel safer
- ◆ I am concerned about damaging earthquakes in this building's neighborhood

Other common reasons in Berkeley for doing the structural work in order of importance are:

- ◆ I thought it was a good investment, or a good selling point
- ◆ The City or county helped or encouraged me (primarily through the property transfer tax rebate program)

In Oakland, other common reasons, in order of importance, for doing the structural work included:

- ◆ I found out about a problem when I bought the building
- ◆ I thought it was a good investment, or a good selling point

Reasons Structural Work Not Done

The most common reasons for not completing structural work varied greatly by sample. However, three primary reasons for doing the retrofit work emerged from each sample – despite differences in each sample's order of importance. These most common reasons are noted below (in no specific order):

- ◆ I haven't gotten around to it
- ◆ I don't know what I need to do
- ◆ I think it *costs too much* for me to do

ATTACHMENTS

The attachments include:

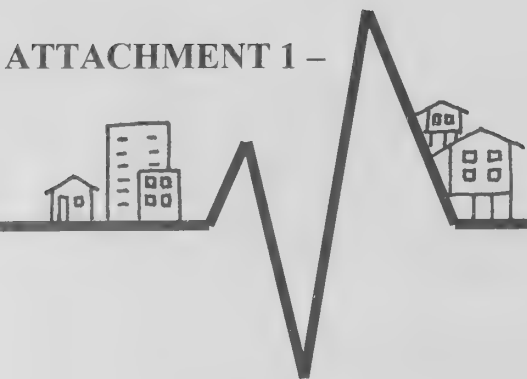
1-The four-page survey sent to multifamily building owners.

2-Three postcards mailed to building owners. A postcard was first sent out to inform building owners that the survey would soon arrive. After the original survey was mailed out, a reminder postcard was sent to building owners that had not returned the original survey. Following the mail-out of the second copy of the survey, an additional postcard was sent to Oakland building owners in an attempt to boost the response rate of this City's building owners. Mary King, from Alameda County's Board of Supervisors signed the postcard and allowed us to state on it that responding to the survey would be ultimately helpful for Oakland's residents.

3-A letter sent to building owners that was included in the second survey mail-out.

Bay Area Earthquake Safety

SURVEY



The Association of Bay Area Governments (ABAG) is working with Bay Area cities and counties to improve earthquake safety programs. As part of this work, we are conducting this survey of owners of Bay Area multi-family housing. Your answers are being combined with those of others to develop statistics on how prepared we are for future earthquakes, as well as why housing owners may chose to retrofit. Your participation will help us design programs to help our cities be better prepared. Few property owners are being sent this survey, so your answers are very valuable to us.

Please help us by taking a few minutes to answer the questions. After finishing the survey, mail it back to ABAG in the envelope provided. ***No stamp or postage is necessary.*** This survey is paid for by the National Science Foundation and the cities and counties of the Bay Area.

Please give us any comments on the back of this survey. If you have questions, call Kathleen Mikulis at ABAG at (510) 464-7923, or e-mail her at kathleenm@abag.ca.gov.

Thank you.

Sincerely,

A handwritten signature in cursive script that reads "Jeanne Perkins".

Jeanne Perkins
Earthquake Program Manager
Association of Bay Area Governments

Please answer the following questions about your multi-family residential property at:

If you no longer own this home, please return the blank survey and check here: ☐

ABAG EARTHQUAKE SAFETY SURVEY

PART I -

1. How many stories high is this building (above ground, including parking) _____ (Fill in number)
2. How many units are in this building? _____ (Fill in number)
3. Is there parking or a garage on the first floor **with living units above it**? Check ONE.
☐ Yes, the entire first floor ☐ Yes, part of the first floor ☐ No
4. What is the approximate decade this building was originally built? _____ (1950s, etc.)
5. Has this building been substantially changed with a major renovation? Check ONE.
☐ Yes ☐ No
6. Which of the following precautions have been taken for this building, and when did they occur?
(These are called **nonstructural** measures.) Check ONE for EACH precaution.
 - a. All water heaters are braced or strapped to a wall?
☐ Yes, before I bought the building ☐ Yes, after I bought the building ☐ No
 - b. The chimney(s) is braced?
☐ Yes, before I bought the building ☐ Yes, after I bought the building ☐ No chimneys ☐ No
 - c. A special gas shut-off valve triggered by shaking or a gas leak detector is installed?
☐ Yes, before I bought the building ☐ Yes, after I bought the building ☐ No
7. Which of the following **structural** measures have been taken for this building, and when did they occur? Check ONE for EACH precaution.
 - d. The building is bolted to its foundation?
☐ Yes, before I bought the building ☐ Yes, after I bought the building ☐ No
 - e. Plywood has been added in the crawl space?
☐ Yes, before I bought the building ☐ Yes, after I bought the building ☐ No crawl space ☐ No
 - f. Additional strengthening of a garage door opening or parking area has occurred?
☐ Yes, before I bought the building ☐ Yes, after I bought the building ☐ No parking or detached ☐ No
8. For those responses in Question 7 where no **structural** work has occurred, why have you decided **not** to do that work on this building? Check ALL that apply.
☐ I don't know anyone else who has done it.
☐ I don't know what I need to do.
☐ I think it's too **hard** to do.
☐ I think it **costs too much** for me to do.
☐ I don't think that earthquakes are much of a problem in this building's neighborhood.
☐ I do not have the ability to get or repay the loan required to pay for the work.
☐ I think it's a bad investment.
☐ I haven't gotten around to it.
☐ I was afraid or intimidated by the City or county, such as the building or planning department.
☐ I'm afraid my property taxes will go up if I do it.
☐ I know I'm not going to own this building for very long.
☐ I have earthquake insurance instead.
☐ Other _____

9. If any earthquake strengthening was done before you purchased this building, was it a factor in your decision to purchase this building? Check ONE.

☐ Yes, a lot ☐ Somewhat ☐ Not much ☐ Not at all ☐ Not applicable

If any earthquake strengthening has been done on this building while you've owned it, continue with questions 10-15. Otherwise, skip to Part II.

10. Date(s) work was done: _____ (Fill in year. If you've done more than one strengthening project, list years.)
11. Who did the retrofit work? Check ONE.
☐ I did all the work myself.
☐ I hired a contractor to do the work.
☐ I did some of the work myself, but also hired a contractor.
12. How did you pay for the work? Check ALL that apply.
☐ Loan or refinance ☐ Cash or credit card
☐ Support from a government program _____ (explain)

13. Did you hire or talk with a structural engineer prior to retrofitting this building? **Check ONE.**
☐ Yes ☐ No
- 14a. Approximately how much money did you spend on **all** work? \$ _____
- 14b. Approximately how much money did you spend on the **earthquake retrofit** work? \$ _____
15. Why did you decide to do the work? **Check ALL that apply.**
- ☐ I knew someone else, such as a friend, who had also strengthened their home or rental.
 - ☐ I am concerned about damaging earthquakes in this building's neighborhood.
 - ☐ I found out about a problem when I bought the building.
 - ☐ I got a letter or call from a contractor offering to do the work.
 - ☐ I thought it was a good investment, or a good selling point.
 - ☐ The City or county helped or encouraged me. (How? _____)
 - ☐ I thought my property taxes would NOT go up if I did this.
 - ☐ I thought that I could retrofit this building and not need earthquake insurance.
 - ☐ I did the work because the building was damaged in an earthquake.
 - ☐ I found out I would get a discount on my earthquake insurance.
 - ☐ I was concerned after I saw damage to similar buildings in an earthquake.
 - ☐ I became concerned after earthquake scientists talked about Bay Area earthquakes.
 - ☐ I wanted to feel safer or to have my tenants feel safer.
 - ☐ Other _____

PART II - The following questions will help us classify your responses and are OPTIONAL.

- A. Where did you live in 1989 when the Loma Prieta earthquake happened? **Check ONE.**
- ☐ In this building
 - ☐ Not in this building, but in California _____ (City name)
 - ☐ Outside of California
- B. Have you ever experienced a major damaging earthquake? **Check ONE.**
- ☐ Yes ☐ No
- C. What do you believe is the risk of a future **major** Bay Area earthquake? **Check ONE.**
- ☐ Very High ☐ Moderately Low
 - ☐ Moderately High ☐ Very Low
- D. Do you know someone (such as a friend or neighbor) who has done additional **structural** work on their home or rental to provide for additional safety in an earthquake?
- ☐ Yes ☐ No (For examples, see Question #7.)
- E. Have you seen ABAG's earthquake shaking maps for the city where this building is located?
- ☐ Yes ☐ No
- F. Do you live in this building? **Check ONE.**
- ☐ Yes, I live in a condo unit which I own ☐ No, I rent out this condo unit
 - ☐ Yes, I own the entire building and live in one of the units ☐ No, I rent out all the units
 - ☐ No, it is vacant
- G. Do you have earthquake insurance for this building? **Check ONE.**
- ☐ Yes
 - ☐ No, but I used to. I stopped paying for insurance in _____ (year).
 - ☐ No, I have never purchased earthquake insurance for this building.
- H. Do you have food and water at **your** home to help you survive after an earthquake? **Check ONE.**
- ☐ Yes, for more than 4 days ☐ Yes, for 1-2 days
 - ☐ Yes, for 3-4 days ☐ No
- I. How much school have you completed? **Check HIGHEST degree received.**
- ☐ I attended school, but did not complete High School (12th grade).
 - ☐ I graduated from High School (or equivalent, such as GED).
 - ☐ I graduated from college (Bachelor's degree or higher).
- J. What is your approximate family income? **Check ONE.**
- ☐ Less than \$20,000 / year ☐ \$60,000 to \$79,999 / year
 - ☐ \$20,000 to \$39,999 / year ☐ \$80,000 to \$99,999 / year
 - ☐ \$40,000 to \$59,999 / year ☐ More than \$100,000 / year
- K. May we contact you if we have any questions? **Check ONE.**
- ☐ No ☐ Yes

Name _____
 Phone _____
 Best time to call _____

Again, if you have questions, call Kathleen Mikulis at ABAG at (510) 464-7923, or e-mail her at kathleenm@abag.ca.gov. Thank you for your time! Please mail this survey back to us.

Give us your comments here –

ATTACHMENT 2 –

The three postcards mailed out to multifamily building owners during the course of the survey are included here. On the right is the first postcard mailed to all building owners preceding the original survey mail-out on June 23, 1999.

Below is the reminder postcard sent on July 14, 1999 to all building owners who did not return this original survey.

At the bottom right corner is the postcard mailed to Oakland building owners on August 6, 1999 that had not returned either the original or the second copy of the survey.

ASSOCIATION OF BAY AREA GOVERNMENTS

Representing City and County Governments of the San Francisco Bay Area

A couple of weeks ago you received an Earthquake Safety Survey from the Association of Bay Area Governments asking about measures you have taken to prepare a residential building you own for future earthquakes. Our records indicate that you have not returned this survey. Please take a few minutes to fill it out now and return it to us. Your answers are important ***whether or not you have done any structural work on this building.*** In addition, ***if you no longer own the building, or if it is now a single-family home, rather than a multifamily building, we are still interested in your responses.*** If you need another copy of the survey, give us a call at 510/464-7929 to request one. Again, we would like to stress that your answers are anonymous. Your City or County will not receive your name or address, nor will building contractors.



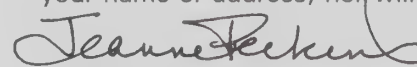
Jeanne Perkins
Earthquake Program Manager
ABAG P.O. Box 2050 Oakland, CA 94604

ASSOCIATION OF BAY AREA GOVERNMENTS

Representing City and County Governments of the San Francisco Bay Area

In about a week you will be receiving an Earthquake Safety Survey from the Association of Bay Area Governments asking about measures you have taken to prepare a residential building you own for future earthquakes. Your answers will be combined with those of others to develop statistics on how prepared we are for future earthquakes. We plan to use the information from this survey to help us improve the safety of the Bay Area. Therefore, please complete the survey and return it to ABAG. Your participation is important, ***whether or not you have done work on this building.***

Your answers are anonymous. Your City or County will not receive your name or address, nor will building contractors.



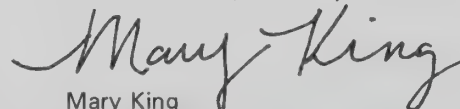
Jeanne Perkins
Earthquake Program Manager
ABAG P.O. Box 2050 Oakland, CA 94604

ASSOCIATION OF BAY AREA GOVERNMENTS

Representing City and County Governments of the San Francisco Bay Area

Recently you received an Earthquake Safety Survey from the Association of Bay Area Governments asking about measures you have taken on a residential building you own so that it may experience less damage in future earthquakes. Oakland, Berkeley and other communities in Alameda County hope to use the results of this survey to help us improve the safety of our communities. Therefore, if you have not already done so, please complete the survey and return it to ABAG. Your participation is important, ***whether or not you have done work on this property.***

Your answers are anonymous. No city will receive your name or address, and we will not use this information for code enforcement. If you did not receive a questionnaire, or if it has been misplaced, please call ABAG at 510/464-7929, and they will be happy to mail you another.



Mary King
President, ABAG and Alameda County Supervisor
ABAG P.O. Box 2050 Oakland, CA 94604



ATTACHMENT 3 -

July 27, 1999

About a month ago we mailed you the enclosed blue survey related to what you may or may not have done to better prepare your residential property for future earthquakes.

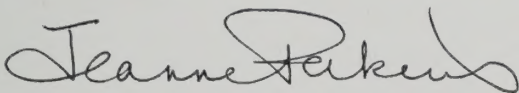
We are extremely interested in finding out if people who rent out these buildings are more, or less, likely to have done something to make these homes safer in earthquakes than those who both own and live in the property. In addition, we want to compare information on the types of actions taken, or not taken, by owners of single family homes versus multifamily residential buildings.

The questionnaire was only mailed to a few owners of residential buildings in the Bay Area. Therefore, it is very important that we hear from you.

We want to make sure that any program we design to encourage people to retrofit (through classes on how to retrofit these homes yourself, financial incentives, hands-on help by city building departments, or in other ways) *works* for both rental and non-rental properties.

Please take a few minutes, fill out this questionnaire, and return it in the enclosed envelope. If you don't know the answer to a particular question, just note this on the survey and fill out as much of it as you can. Thank you for your time.

Sincerely,

A handwritten signature in cursive script, appearing to read "Jeanne Perkins".

Jeanne Perkins
ABAG Earthquake Program Manager

Enclosed survey and return envelope

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ASSOCIATION
OF BAY AREA
GOVERNMENTS

MetroCenter
Eighth & Oak Streets
Oakland
(510) 464-7900

Mailing Address:
P.O. Box 2050
Oakland, CA 94604-2050

**EARTHQUAKE
PREPAREDNESS
PROGRAM**

